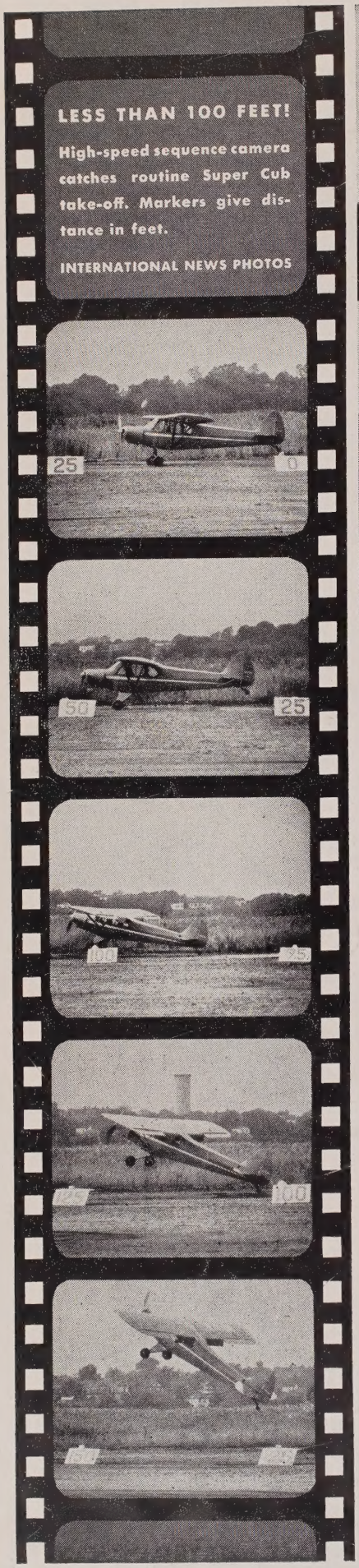
SKYWAYS

SIAN AIR FORCE
0

dio Navigation
the Amateur

. . . page 18

5¢


LESS THAN 100 FEET!
High-speed sequence camera catches routine Super Cub take-off. Markers give distance in feet.
INTERNATIONAL NEWS PHOTOS

ANNOUNCING THE 1951

SUPER CUB

with 125 HORSEPOWER and DURACLAD Finish

From canyon bottoms of the Colorado River to barren islands in the Bering Sea, the Super Cub has hauled loads in and out of places no other commercial plane can go!

Now with 125 horsepower for 1951, the Super Cub's performance is made even more spectacular. The Super Cub "125" cruises better than 100 mph, takes off in less than 100 feet, flies as slow as 33 mph and lands within five lengths of its own fuselage! With a 1,500-pound gross weight, it clears a 50-foot barrier in 600 feet!

Added, too, for 1951 is the remarkable new Duraclad finish, standard on all Piper planes—a nonflammable, plastic covering which is tougher, longer lasting—ideal for lowest cost maintenance.

When flown under new special-purpose flying provisions of C.A.R., the Super Cub can easily handle a 1,000-pound load. With a half ton on board, the Super Cub clears a 50-foot barrier in 950 feet.

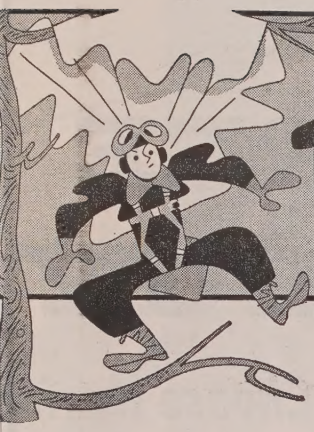
On floats, skis or tandem gear, the Super Cub is a most versatile airplane—widely used by farmers, ranchers and sportsmen as well as operators. See your dealer for a demonstration. You've never flown anything like it! For brochure write Dept. K-1.

The Super Cub is also available with 90 horsepower—an ideal plane with abundant performance for training and general utility work.

PIPER

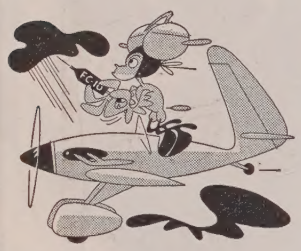
PIPER AIRCRAFT CORP.

LOCK HAVEN, PA., U. S. A.



The Birdmen's Perch

RAIN—by any other name, would still be a pain in the windshield if a certain distinguished Canadian doctor hadn't recently come up with a remarkable new compound, called FC-10, that will be on the market any day now.



FC-10, *an invisible rain-repellent wax*, can be applied to a plane's windshield in about fifteen minutes, and one application will last from a week to two months, depending on the care and preparation of the windshield.

There's a compound for glass, another for plexiglass. Either sheds rain like water off the proverbial duck's back, assuring high visibility at speeds ranging from 600 down to 50 miles per.

No matter how you slice it, this is a real boon, especially to planes without windshield wipers.

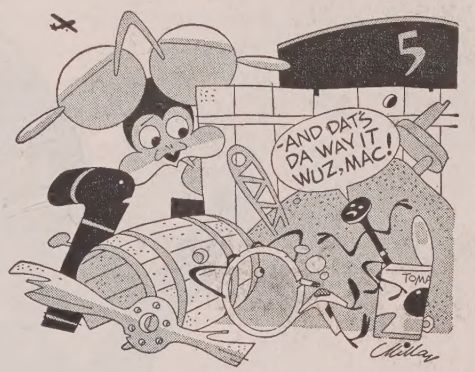
BUT NOW—A PLAY!

(The scene is that junk heap out behind Hangar 5. A worn-out valve and a beat-up piston ring are discussing their misspent lives)

VALVE: Look at it this way, Ferdie! If I had my life to live over again, I'd never touch a drop of anything but Gulfpride Aviation Oil—Series D!

RING: Same here! It was just rotten luck I learned too late that Gulfpride Aviation Oil—Series D—is the finest detergent dispersant oil for horizontally opposed engines there is!

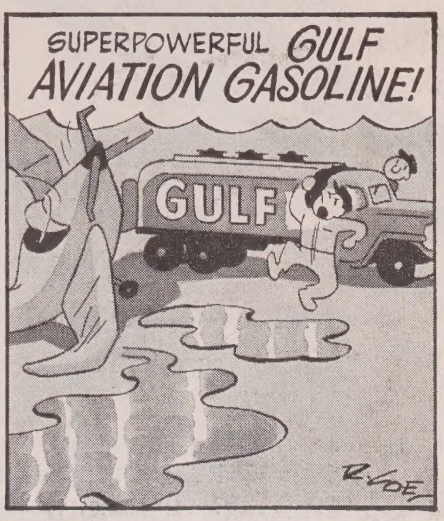
VALVE: Pilots are like that! They never forget how to do an outside loop, but how many of 'em remember about the only aviation oil put through Gulf's exclusive Alchlor process to remove carbon and sludge formers?



RING: You can say that again! And besides, Gulfpride Aviation Oil—Series D—increases those periods between overhauls up to 100%! Ah, well, better luck next incarnation —what?

GULF

AVIATION PRODUCTS



Gulf Oil Corporation . . . Gulf Refining Company

45917

Vol. 10, No. 1, January, 1951, SKYWAYS is published monthly by J. Fred Henry Publications, Inc., 444 Madison Ave., New York 22, N. Y. Printed in U.S.A. Single copy 25 cents. Subscription Prices: U. S., possessions, Canada and Pan-Am. Union $7.00 for three years, $5.00 for two years, $3.00 for one year; all other countries add $1.50 per year for postage. Six weeks required for address changes (give both old and new address.) Manuscripts, drawings, other material must be accompanied by stamped, self-addressed envelope. SKYWAYS is not responsible for unsolicited materials. Reentered as second-class matter April 16, 1948, at the post office at New York, N. Y., under the act of March 3, 1879. Copyright 1950 by J. Fred Henry Publications, Inc.

FLY ALL THREE BEFORE YOU BUY!

We Sincerely Believe You'll Choose Navion

BE SURE OF GETTING ALL THE QUALITIES YOU WANT MOST in an airplane . . . *fly all three before you buy.* Call your Navion dealer today for a demonstration flight. Take the wheel yourself. Note how easily it flies. *Make your own direct comparisons on the complete check list at right.* Discover for yourself how the Navion's greater number and better combination of superior features make it a better over-all plane for *you.*

RYAN AERONAUTICAL COMPANY
201 LINDBERGH FIELD, SAN DIEGO, CALIFORNIA

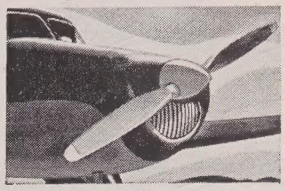
Ryan Navion

NAVION INVITES COMPARISON!
Check All These Points Yourself

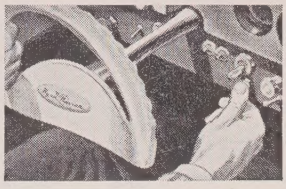
PERFORMANCE	SUPER NAVION	PLANE B	PLANE C
Cruising Speed (full load)	170 m.p.h.		
Rate of Climb (full load)	1250 f.p.m.		
Take-off Run (full load)	400 feet		
Service Ceiling (full load)	18,000 feet		
Range at Maximum Cruise	681 miles		
Fuel Cost	2¢ per mile		
SAFETY			
Slow-Flight Stability	Aileron control below 55 m.p.h. stall		
Landing Roll	470 feet		
Landing Speed	55 m.p.h.		
Lift-Flap Efficiency	43° Deflection—63% more lift		
Visibility	360°—7 Windows		
Power Plant	Lycoming 260 h.p.		
Fuel System	Dual Pumps		
EASY FLYING			
3-Way Stability	Fly "Hands and Feet Off"		
Controls	Exclusive Inter-connected system		
ROOMINESS & COMFORT			
Cabin Dimensions	Width 43" Head Room 38"		
Leg Room	40" to 50"		
Front Seats	Adjust Individually		
Sound Level	None Quieter		
Propeller Noise	Quiet—1765 R.P.M.		
Useful Load	953 Pounds		
RUGGEDNESS			
All-Metal Heavy Gauge	Yes—.040 to .032 Leading Edge		
Low-Wing	Yes		
Tri-Cycle Gear	Yes—Main Wheels 7.00 x 8		
Steerable Nose-Wheel	Yes—6.00 x 6		
Exterior Finish	Durable Enamel Overall		

LUGGAGE MASTER permits loading and unloading of baggage without entering cabin. Folding seat gives access to baggage in flight.

BEAUTIFUL NEW UPHOLSTERY in rich colors and luxurious fabrics; leather trim. Styled by Charles of California. Foam rubber cushions.



HARTZELL ALL-METAL SELECTIVE PITCH PROPELLER is now available. Adjustable cowl flaps give improved engine cooling, better performance.



NEW "REVERSE FLOW" VENTILATION system sets new standard for abundant fresh air circulation. Push-button starter on dash.

NO OTHER PLANE COMBINES SO MANY FEATURES SO WELL

AVIATION
AN ESSENTIAL INDUSTRY
IN PEACE OR WAR

AERONAUTICAL ENGINEERING
MASTER AVIATION MECHANICS
JET ENGINE Maintenance and Overhaul

AVIATION CAREER

WHERE will you be in 1951?

in military service or preparing for a future career?

"DO DOUBLE DUTY"

Duty — to your country in case of military service — *Duty* to yourself for a successful civilian career and secure future.
Prepare for this DOUBLE DUTY with one overall highly contracted period of comprehensive training at Cal-Aero Technical Institute.

IN CASE OF MILITARY SERVICE — upon graduation—you will be prepared and in line for higher grades and ratings should you enter the U. S. Air Force. CAL-AERO trained 25,000 pilots and 7,500 technicians for the Military Air Forces during World War II.

IN CASE OF YOUR FUTURE CIVILIAN CAREER —upon graduation, you can step right into an AVIATION CAREER with good pay, and a secure future, without break-in.

INVESTIGATE AND COMPARE

CAL-AERO graduates occupy good positions at all famous plants, including Douglas, Northrup, Convair, North American, Lockheed, and Boeing. Cal-Aero graduates are in demand — 7,000 of them are on the job. Established 1929, Cal-Aero, is an independent subsidiary of Grand Central Aircraft Co., world's largest facility for maintenance and modification of private, commercial and military aircraft.

CAL-AERO NOW TRAINING MILITARY PERSONNEL under contract to the U. S. Air Force, in addition to its regular civilian program. Cal-Aero was chosen as one of two, from all Aviation Schools in the nation, to do this job.

WHAT BETTER RECOMMENDATION WOULD A SCHOOL HAVE?

CAL-AERO TECHNICAL INSTITUTE

**GRAND CENTRAL AIR TERMINAL
GLENDALE 1, CALIFORNIA**

MAIL COUPON TODAY

CAL-AERO TECHNICAL INSTITUTE
Grand Central Air Terminal, Glendale 1, Calif.
Send full information and free catalog, immediately

☐ AERONAUTICAL ENGINEERING
☐ MASTER AVIATION MECHANICS
☐ JET ENGINE—Maintenance & Overhaul

HOME STUDY COURSES
☐ Aeronautical Drafting ☐ Aircraft Blueprint Reading
☐ Stress Analysis and Design

NAME AGE
ADDRESS
CITY ZONE STATE
HIGH SCHOOL ATTENDED Graduated: Yes ☐ No ☐
S-1 Check one: ☐ Veteran ☐ Non-Veteran

SKYWAYS

Cover: Beech Bonanzas — *January 1951*

Russian Air Force . . . . . Wm. Green & Roy Cross 10
A look behind the Iron Curtain proves Soviet has A-1 jet air force

Backyard Racer 13
Detroit flight school operator builds himself a midget racing plane

The Story Behind the Headlines . . . D. N. Ahnstrom 14
The planes are safe, but the pilots sometimes forget those G's

Selling to the Air Navy . . . . . Col. N. F. Silsbee 16
If you want the Gov't as a customer, here's how to manage it

Radio Navigation for the Amateur
Chas. W. Soderstrom Jr. 18
How a novice at radio navigation used radio to set new X-C record

Exercise Rainbow 20
Joint Army, Navy, Air Force maneuvers staged in U.S. Zone of Germany

Air Markers are Insurance . . . . . Gertrude Moran 22
Skyway signposts are Number 1 aid to cross-country flyers

Tokyo Airlift . . . . . Don Downie 24
SKYWAYS' Western Editor goes along as co-pilot on air trip to Japan

New on the Market 27
Anderson Greenwood announces the CAA certification of its new Model AG-14

Ready for Winter . . . . . Gilbert C. Close 28
If your plane is set up for it, winter flying can be safe and fun

Dilbert . . . . . S. H. Warner & Robt. Osborn 30
Dilbert is the guy who stays on VFR when the weather closes to IFR

NAVICOM . . . . . Edited by Col. N. F. Silsbee 53

Is OMNI Good Enough . . . . . Irvin Nye 55
Bad Weather by Radar . . . . . Frank C. White 57
Flying the Omnimatic . . . . . Col. N. F. Silsbee 58
Airline Flies Omni Airway 59

Index for 1950 61

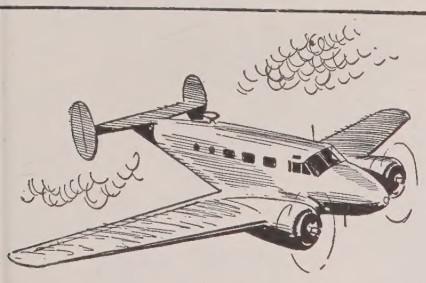
Air your views 6
Military Aviation . . . 8
CAOA News 32
Hangar Flying 46
Airmen's Quiz 64

J. FRED HENRY . . . Editor and Publisher
D. N. AHNSTROM . . . Managing Editor DON DOWNIE . . . . . Western Editor
CHARLES W. ADAMS . . . . Art Director STANLEY M. COOK . Production Manager
ANNE MASCHKE . . . Asst. Art Director ARTHUR KAPLAN, Circulation Mgr. (Newsstand)
BENNETT H. HORCHLER . Advertising Director A. E. CARDWELL . Circulation Mgr. (Subs.)

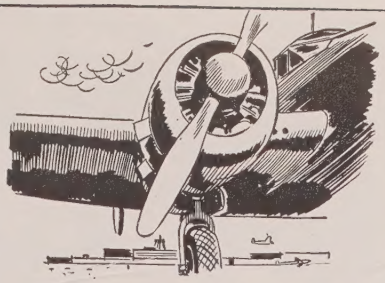
JANUARY 1951 VOLUME 10, NUMBER 1

J. Fred Henry Publications, Inc. publishes SKYWAYS at 444 Madison Avenue, New York 22, New York. Advertising Offices: 444 Madison Avenue, New York 22, N. Y.; 6 N. Michigan Ave., Chicago 2, Ill.; 816 W. 5th Street, Los Angeles 13, Calif. Gordon Simpson, West Coast Manager. William H. Thomas, Chicago Manager.

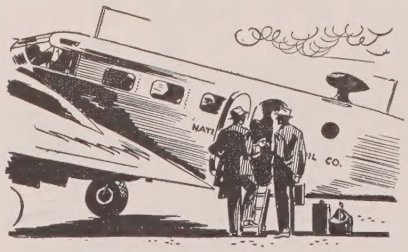
The following publications are combined with SKYWAYS: Air News and Flying Sportsman. All rights to these names are reserved by J. Fred Henry Publications, Inc.



Choose it for speed and performance. With a maximum speed of 230 mph, you're in a class with the Airlines — and you have unsurpassed mobility of action, too.

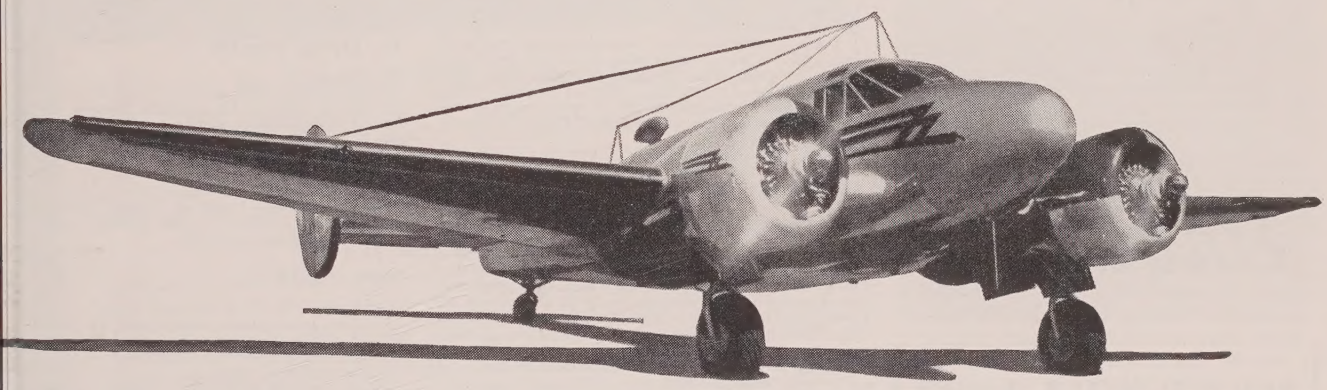


Choose it for safety. Twin-engine reliability and outstanding single-engine performance provide an assurance of mental ease when flying in less favorable weather conditions.



Choose it because it has proved itself. Wartime versions rolled up hundreds of millions of miles. Today, more than 500 postwar Beech "Twins" are serving leading industries.

For the ultimate in air transportation choose the Beechcraft Executive Transport



Features place the Model D18S in a class by itself

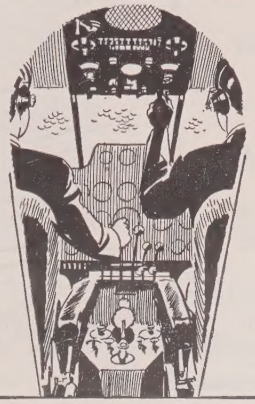
200-mph cruising speed
Rate of climb at sea level, 1,200 feet per minute
Range up to 900 miles
20,500-foot service ceiling
Custom seating arrangement for 7, 8, or 9
Luxurious, temperature-controlled interior
Individual reading lights, ash trays, etc.

● For full information contact your nearest Beechcraft distributor or write on your company letterhead today to Beech Aircraft Corporation, Wichita, Kansas, U.S.A.

Beechcraft
EXECUTIVE TRANSPORT

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

Choose it for luxury. Several custom-interior plans available. Sound-proofed cabin, restful seats, wide windows. You'll feel no travel fatigue here!



And it's the choice of pilots. Extremely efficient instrument and control layout, with major operating units conveniently located on central pedestal.

NOW!
SPEED UP ALL SOLDERING WITH
UNGAR
FEATHER-LIGHT SOLDERING PENCILS WITH
HI-HEAT
INCREASED WATTAGE
TIPS

For use with No. 776
Handle & Cord Set

Stop wrestling with *big* irons. New HI-HEAT TIPS in your Ungar Electric Soldering Pencil produce a really versatile tool that'll perform on a par with the big, bulky 100-150 watt irons. If you can't get immediate delivery, please be patient, for production hasn't yet caught up with demand. Ask your supplier for No. 1236 Pyramid or No. 1239 Chisel. List price, $1.25 each.

Ungar
ELECTRIC TOOL CO., Inc.
LOS ANGELES 54, CALIFORNIA

HERE AT LAST!

An Approved School
for training in

Aerial
PHOTOGRAPHY
PHOTO-LAB TECHNIQUE
MAP MAKING
SURVEYING

•

Completely Equipped Mapping Airplanes

•

Modern Complete Laboratory Facilities

•

Expert Instructors—Years of Professional Experience

•

SECURE YOUR FUTURE IN AN EXPANDING FIELD
MANY JOB OPPORTUNITIES
FREE PLACEMENT SERVICE

Enroll Now!
NEW SCHOOL OF PHOTOGRAPHY
44 Commerce Street
Newark 2, New Jersey

AIR YOUR VIEWS

Commuter Plane

Gentlemen:

Could you give me some information about the Culver PQ-14A that a Connecticut pilot converted into a personal plane?

I am a college student studying aero engineering and I want a good way to travel back and forth to school. The best way is to fly, but I can't afford to spend much for a plane. I probably could buy a *Cub* second-hand, but I feel a *Cub* is too slow. I want a fast job and that Culver, I think, has a good speed.

What do you think?

BOB FLINT

Greenwood, S. C.

You are right on one score—the Culver is a fast airplane. However, the consensus of opinion among pilots and A & E's in this section is that the cost of converting a PQ-14A for your personal use would cost you more than buying a good second-hand airplane already built to meet your requirements. The other hitch to your scheme is the fact that there aren't many PQ-14A's available. Might we suggest that you contact some reliable aircraft service operator in your locality, and talk over your problem with him. Most such operators are well versed in the performance and handling qualities of all personal planes, and they aim to please in dealing with prospective customers. Ask that aircraft service operator. He'll give you the best advice for both your need and your wallet.—ED.

Air Friends in Italy

Gentlemen:

The authors of this letter are members of the Air Sport Club, founded and directed by ex-war pilots. These pilots are the ones who fought for the same ideals and in the same airplanes (*Aircobra*) alongside and in cooperation with American pilots based at Lecceon in the Balkans. Herewith, they are begging you to help them by sending all American pilots belonging to the Civil Air Patrol this appeal and request for an already old and dusty Piper *Cub* which may enable them to soar in the sky and to cooperate in the revival of the Air Force in this country by instructing and training in the secrets of flight to help young men realize their dreams to fly.

The bad condition of the air industry in Italy imposes heavy expenses which are far superior to the limited possibilities. For this reason and through the remembrance of the days spent side by side and wing to wing for a common aim, the pilots of the A.M.A. appeal to their comrades of the past and perhaps those of the future, and hope that they may find in the American pilots the helpers that would generously assist them in putting old fighters and young students back into the sky.

Send to the Civil Air Patrol the best wishes and greetings of the members of this club.

D. VECCHI, Pres.
L'Associazione Modenese Aeronautica
Modena, Italy

Request noted . . . and passed on with our every good wish for fulfillment.—ED.

Air Report on Far East

Gentlemen:

Re: "Air Report on the Far East," by Martin Caiden, I quote: "For a great mechanized land war will never be fought across the picturesque Japanese terrain. The very nature of that terrain precludes such an occurrence." (The author has just finished discussing Russian superiority in tanks.)

Now isn't that precisely what our "experts" said about Korea before the war there?

CHARLES KONIGSBERG
Los Angeles, Calif.

Yup—ED.

Re: Flying Saucers

Gentlemen:

Suggest you send Arentz a box Brownie and let him shoot away at his saucers. That is, if he's not afraid the pictures will be confiscated! SKYWAYS could score a scoop.

D. W. McKIBBEN
Webster, N. Y.

Have you ever seen a Flying Saucer? Your editor hasn't either . . . hm, wonder why Saucers don't like Manhattan.—ED.

More PQ-14

Gentlemen:

I am particularly interested in the Culver PQ-14 pictured in your September issue. I would like to own one of these planes but haven't been able to find one. Could you give me any information that might assist me in locating one?

LT. M. W. JAMES LOWRY AFB
Denver, Colorado

Not very many were built. They were specifically developed as radio-controlled target drones for use in training air and anti-aircraft gunners. I believe a few were available at one time as war surplus. Our only suggestion is that you try the classified advertising section of this magazine.—ED.

Nesting Time

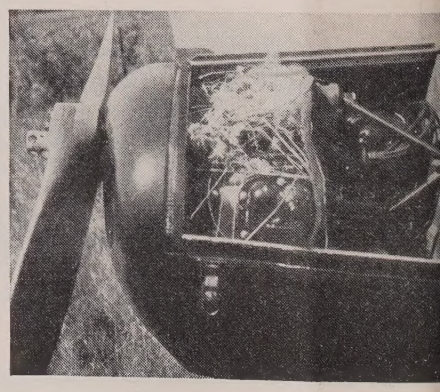
Gentlemen:

Thought you might like to see a picture I took this summer of a sparrow nest built in the engine of a Taylorcraft. Every Sunday I'd remove the nest . . . and the next Sunday there would be another one in its place. Once I found two nests there at one time!

I don't know if this would be of interest to your magazine, but it is a good lesson in safety as the nest, if overlooked, could have caused a fire in the air.

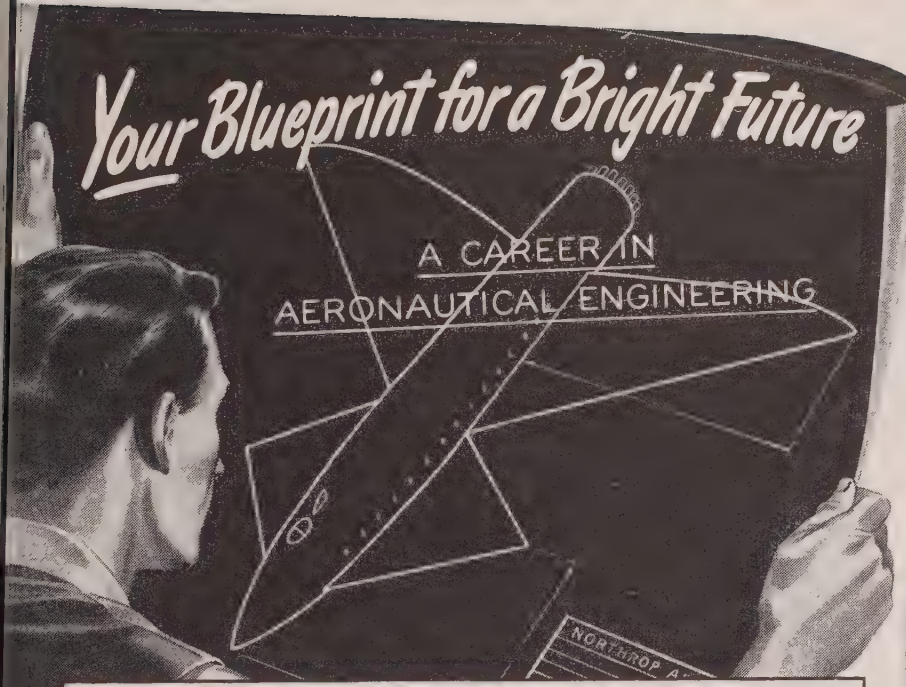
C. JACOBS
Palmyra, Missouri

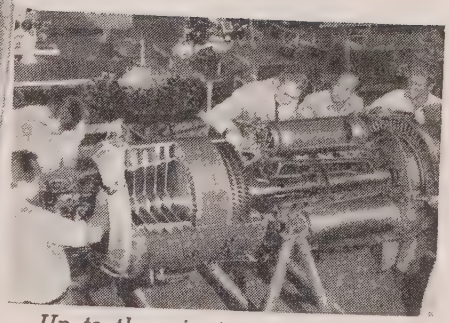
Thanks, Mr. Jacobs. When we next fly out your way, we'll post a bird watch around our plane.—ED.



Your Blueprint for a Bright Future

A CAREER IN AERONAUTICAL ENGINEERING





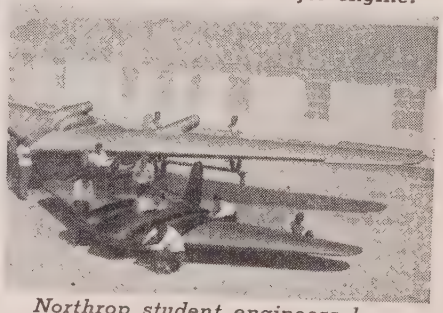
Up-to-the-minute training in Jet Power Plants is one of the many important practical advantages for Northrop students. This group is studying the construction and operation of the powerful General Electric TG-180 turbo-jet engine.

Is This YOU — in '52?

Begin YOUR career NOW, in the most essential of all industries — AVIATION! What wiser choice could you make than choose a career in the industry *you know* is rapidly expanding? There is still time for YOU to be a Northrop Aeronautical Engineering Graduate in 1952! Make the step now that will lead you to Security and Success.

Only at NORTHROP

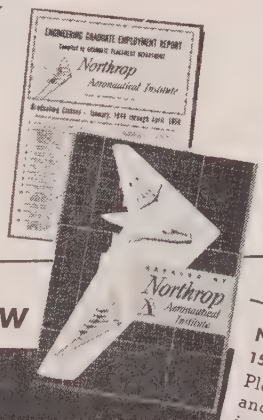
Wherever aircraft are flown, wherever Aviation is known, the name of *Northrop* is recognized and respected. Your Northrop diploma can be your passport to fascinating work and rich rewards in Aviation. Northrop Aeronautical Institute is located in the heart of the Aviation Industry, right on Northrop Field. You study under skilled Northrop Institute instructors. You work with the Institute's own live jet engines, its wind tunnel, its vast array of training equipment — airplanes from small single-engine planes to giant four-engine aircraft!

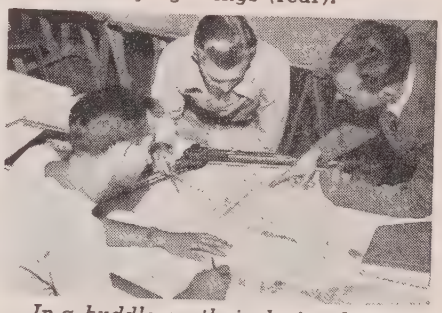


Northrop student engineers learn the principles of advanced all-wing aircraft design, as they study the design and aerodynamic characteristics of a Northrop-built experimental "buzz bomb" (front), and one of the N-9M 60-foot scale model Flying Wings (rear).

The Northrop Graduate Placement Dept.

You are already IN Aviation when you train at *Northrop!* In one year, you can be a graduate aircraft and engine mechanic; in two years you can be a graduate aeronautical engineer! Many Northrop graduates choose to accept positions with Northrop Aircraft, Inc. Many hundreds of others hold good positions elsewhere. Whatever your choice of position, you are assisted by the Northrop Graduate Placement Dept. For further information on positions, read the amazing black-and-white record of recent Northrop graduates, as shown in Graduate Employment report. Send the coupon for your copy today.





In a huddle on their design for the rudder on a student project aircraft, these Northrop students study their assembly drawings, a scene they will repeat many times in their careers.

END COUPON FOR THIS CATALOG NOW

Northrop Aeronautical Institute

21 EAST BROADWAY, HAWTHORNE,
OS ANGELES COUNTY, CALIFORNIA

Division of Northrop Aircraft, Inc.
James L. McKinley, Managing Director

NORTHROP AERONAUTICAL INSTITUTE
1521 E. Broadway, Hawthorne, Los Angeles County, Calif.
Please send Graduate Employment Report, Catalog, and schedule of starting dates of classes. I am interested in: ☐ Aeronautical Engineering ☐ Aircraft & Engine Mechanics

NAME

ADDRESS AGE

CITY ZONE STATE

Check one: ☐ VETERAN ☐ NON-VETERAN

highest approvals

Veterans Administration — Engineers' Council for Professional Development — Civil Aeronautics Administration — National Council of Technical Schools — California State Board of Education — U. S. Dept. of Justice, Immigration and Naturalization Service

MILITARY AVIATION

Grasshopper Scores

While directing the fire of an artillery battery in Korea, a grasshopper pilot lost radio contact with the men on the ground and so proceeded to direct their fire by diving on the target. When the "G" pilot saw that the boys were having trouble following the small plane's directions, he decided to drop a smoke shell to mark the specific target. He zoomed up and around, dove on the enemy guns, then dropped the shell. Although intended only as a reference point, the smoke shell exploded in the midst of the enemy gun position and destroyed it.

Radar Vision

Using an effective combination of radio control and radar tracking, ground pilots at Wright-Patterson AFB are successfully testing the Air Force pilotless OQ-19 target plane from a position 10 miles away. Prior to combining radio control with radar, guidance of the OQ-19 was restricted to an area within the ground pilot's visual sight. Designed to simulate operations of a fighter plane for anti-aircraft and flexible gunnery practice, the OQ-19 is capable of remotely maneuvered high-speed dives and steep turns and can hit a top speed of about 220 mph.

Ryan on Military

T. Claude Ryan, president of Ryan Aeronautical, recently announced suspension of *Navion* personal-plane production for 1951 so that the entire facilities of Ryan can be devoted to military needs. No interruption of the first production release of 150 Ryan *Navion* 1951 models already in process of manufacture is anticipated, nor is civilian *Navion* production being terminated. It is merely being suspended temporarily.

Chase Wins Assault Transport Order

Principal winner of the recent assault transport competition was Chase Aircraft with its YC-122C and XC-123. Chase will move to larger quarters (from Trenton, N.J., to Birmingham, Ala.) to begin immediate but limited production of the YC-122C, while it tools up for quantity production of the XC-123. In the Air Force test, the Chase planes were pitted against the Northrop C-125A and a modified Fairchild C-82.

1,000-mph Props

A newly announced series of propellers will pave the way to speeds up to 1,000 mph for long-range prop-driven aircraft, Curtiss-Wright Corporation revealed recently. Developed by the C-W Prop Division, these props have blades rectangular in shape and square tipped. Both single and dual-contrarotating types are included in this sonic series now being tested by Air Materiel Command of the Air Force at Wright-Patterson AFB. For the present, the props are being used on planes capable of cruising at 500 or 600 mph.

Flight Training

A tip for young men who want to apply for flight training in one of the government services: Capt. W. S. Harris of the Naval Air Station at New Orleans warns that applications for flight training cannot be accepted after those applying have been notified by the Draft Board to report for pre-induction examination. In short . . . if you want to get flight training, apply for it now before your number comes up at your Draft Board.

NAVY'S attack bomber, the AJ-1, recently completed trial landings aboard the aircraft carrier *U.S.S. Coral Sea*. The 17-ton AJ-1 is heaviest plane ever to land on a carrier

HARMON TROPHIES recently were presented to Lt. Gen. Doolittle, Vice Adm. Rosendahl by Pres. Truman in Washington

AJ-1 Does Carrier Duty

The Navy's latest and heaviest aircraft, the North American AJ-1 attack bomber, recently successfully completed trial landings aboard the carrier *U.S.S. Coral Sea*. With an empty weight of more than 17 tons, the AJ-1 became the heaviest plane ever to land aboard a Navy carrier. The AJ-1 was designed for high-speed attack missions from flat-tops, and it has a speed in excess of 350 mph and carries a crew of three. The plane is powered by a unique piston and jet arrangement: two Pratt and Whitney 2300-HP reciprocating engines located under the wings and a single Allison J-33 turbojet mounted in the aft section of the fuselage.

Auto-Pilot for 'Copters

Under a Navy research and development program, automatic helicopter control at last has been achieved. Using a Piasecki XHJP-1, vertical landings and take-offs as well as complete duplication of fixed-wing auto-pilot controlled flight have been made. "Hands-off" flight means the copter can be operated at night and under "blind flight" conditions.

News Notes

GENERAL ELECTRIC has announced it is expanding its jet engine manufacturing facilities at Lockland, Ohio, where J-47 turbojets for the AF are assembled from components supplied by nearly 280 subcontractors.

STRATOS CORPORATION, wholly owned subsidiary of Fairchild Engine and Airplane Corp., has become a division of Fairchild, and will hereinafter be known as Stratos Division.

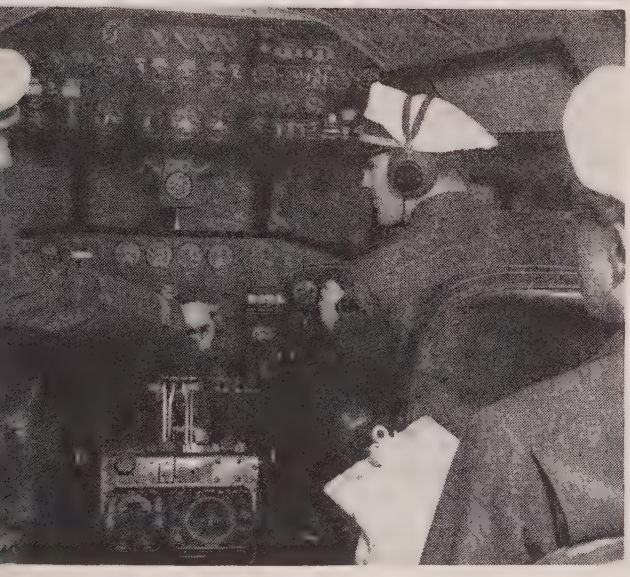
CONSOLIDATED VULTEE has announced the appointment of Gage Irving as assistant to the president, and K. F. Leaman as manager of the company's San Diego Division.

HARMON TROPHIES were awarded to: Lt. Gen. Jimmy Doolittle, Vice Adm. Charles E. Rosendahl and Jacqueline Cochran at ceremonies in Washington recently. President Truman made the presentations.

LEARN AVIATION

PLACE *Yourself* IN THE *Best* COMPETITIVE POSITION TO *Succeed*

BECOME AN AVIATION EXPERT
PREPARE NOW—AT SPARTAN



There is an increasing demand by airlines for Flight Engineers. You can best qualify for these desirable positions by completing Spartan's Multi-Engine Maintenance Mechanic and Flight Engineer courses. These courses do two things for you: (1) prepare you for your C. A. A. Flight Engineer Certificate, (2) qualify you as a maintenance expert. If a Flight Engineer position isn't available when you graduate, you are prepared to work as a maintenance expert until Flight Engineer vacancies occur.

SPARTAN
A UNIVERSITY OF AVIATION

SCHOOL of AERONAUTICS
MAXWELL W. BALFOUR, DIRECTOR

COLLEGE of ENGINEERING
ADDRESS DEPT. S-151

TULSA, OKLAHOMA

Spartan has developed a C. A. A. Flight Engineer trainer that gives you one-half your flight time. It teaches you to overcome accidental feathering of two or more propellers on take-off; loss of oil pressure on four engines; failure of landing gear mechanism, and fire in one or more compartments of the aircraft—situations that dare not be simulated in training aircraft.

Spartan offers you a special folder that explains the opportunities in this new field and the training requirements. Write for your copy of this special MULTI-ENGINE MAINTENANCE MECHANIC AND FLIGHT ENGINEER FOLDER.

MARK AND MAIL *NOW*

Maxwell W. Balfour, Director
Spartan School of Aeronautics **Dept. S-151**
Tulsa, Oklahoma

Please send your free Catalog immediately.

Name_____ Age____

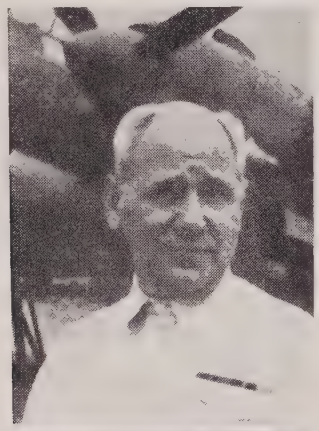
Address_____

City_____ State____

Indicate which of these branches interests you:

☐ Flight ☐ Instruments ☐ Flight Engineer
☐ Mechanics ☐ Aeronautical Engineering
☐ Radio ☐ Airline Maintenance Engineering
☐ Meteorology ☐ Management and Operations

Spartan is approved for training under the G. I. Bill of Rights

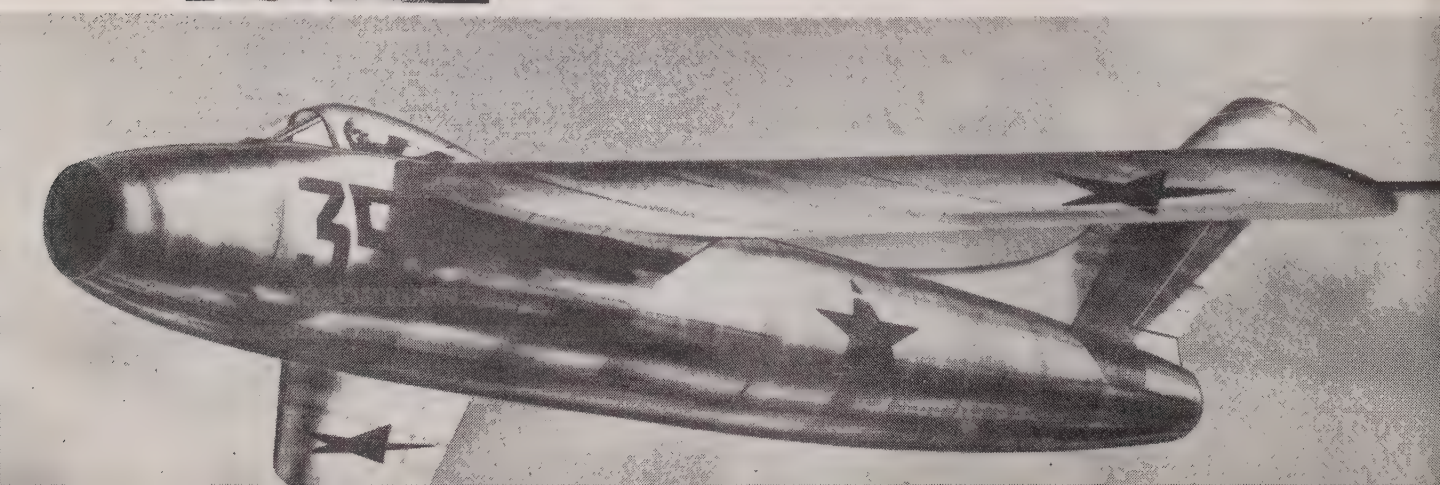


TUPOLEV TU-4, four-engine Russian bomber, is based on U.S. B-29, modified here to conform to the Russian model. Its designer A. Tupolev *(left)* now works on jets

This is the Russian Air Force

Report shows Russians have A-1 jet air force

DESIGNER of interceptor fighters is S. A. Lavochkin *(left)* who designed the La-17, *(below)* which resembles the MiG line. La-17 is powered by version of the *Nene*



By WM. GREEN and ROY CROSS

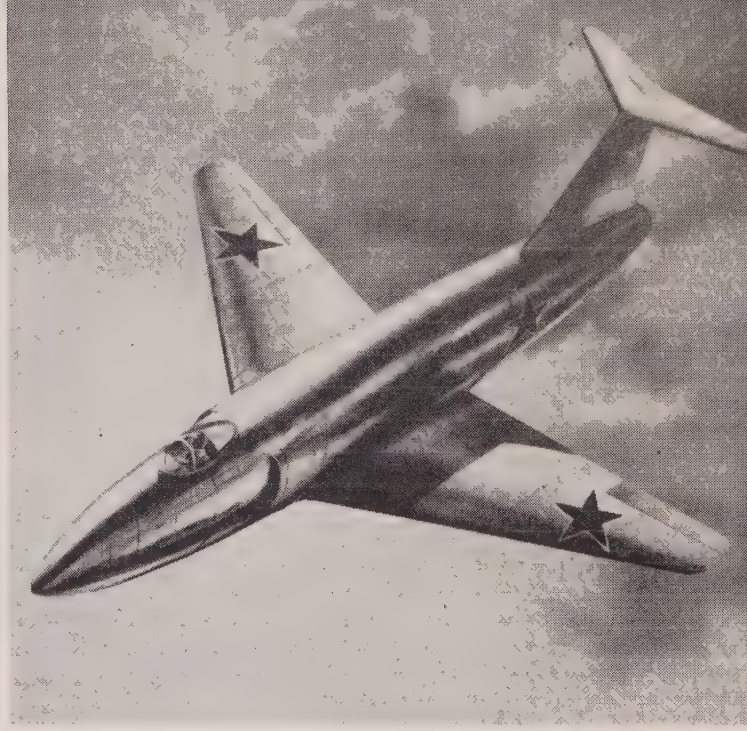
The tendency today seems to be to ridicule the more excessive estimates of Soviet air strength solely on the grounds that they are so much greater than those of the USA. Winston Churchill was probably well informed when he estimated that Colonel-General Zhigarev, who recently took over the command of the Soviet Air Force from Air Marshal Konstantin Vershinin, has over 25,000 planes at his disposal, by which he probably meant first-line modern machines. Estimates of strength are not within the scope of this article, which confines itself to proven facts, or reasonable conjecture based on such facts. On this basis, the weight of evidence that points to the high quality of the latest Red airplanes cannot be ignored. To belittle the Red air potential is a most dangerous course.

It is ironical that there are still those who naively imagine the Soviet Union to consist of millions of illiterate peasants who call each other "little brother" and whose only occupations are to sit around the samovar, drink vodka and await death. How can the optimists reconcile these beliefs with the actual fact of a nation that has vast military resources which increase in strength as every day passes and includes an air armada out of all proportion to the defensive needs of an area even as immense as Russia?

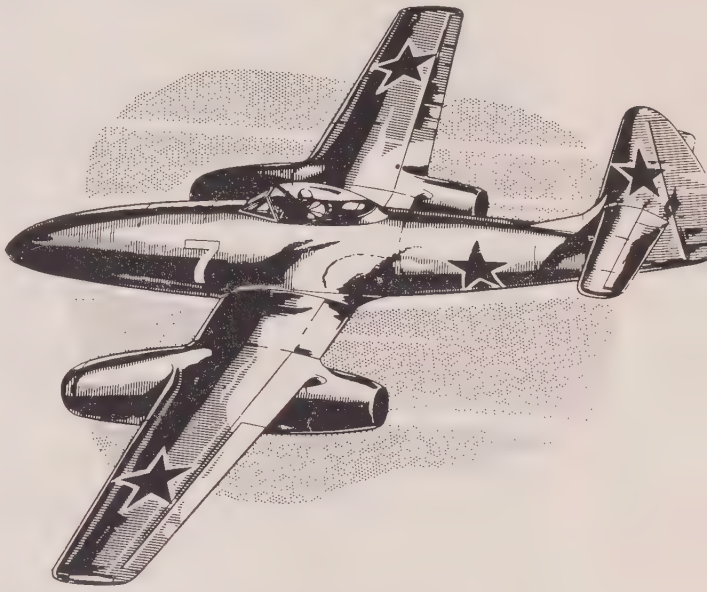
Using the Russian peasant as an illustration, optimists will stress the lower standard of education appertaining in the Soviet Union compared to that of the Western World, but is this factor one that we can afford to take into consideration?

The Soviet policy of industrialization and farm mechanization on a grand scale has brought a rough understanding of mechanics to many millions of Russians, and it is an unquestionable fact that the average Russian has a natural attraction towards things mechanical. This characteristic, combined with enforced devotion to the state and the denial of individual freedom, provides Stalin and the *Politburo* with ideal material for their "people's forces," and constitutes the *real* danger from the Soviet Union.

The Russian is keen to learn, inventive, yet good at imitation; as an airman he is simple-minded, determined and not given to nerves. He is tough, both physically and mentally, and he is a brave fighter. Above all, he firmly *believes* his propaganda. The last war exploded the fallacy that the Russian pilot is of necessity inferior to his Western contemporaries. Given first-class equipment, the Russian is as good as will be found anywhere. Is the "first-class" equipment being supplied by the vast Russian airplane industry? We think that it is! And the facts upon which we base our belief are

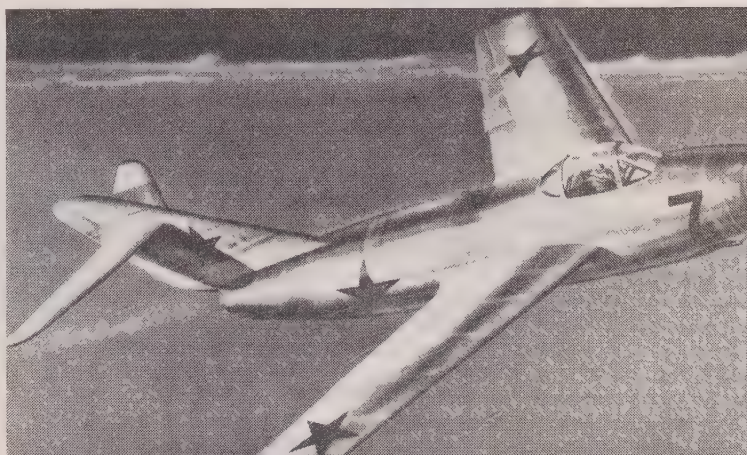


TEST PLANE for many of features appearing in latest Red fighters was this transonic research ship of 1948 vintage



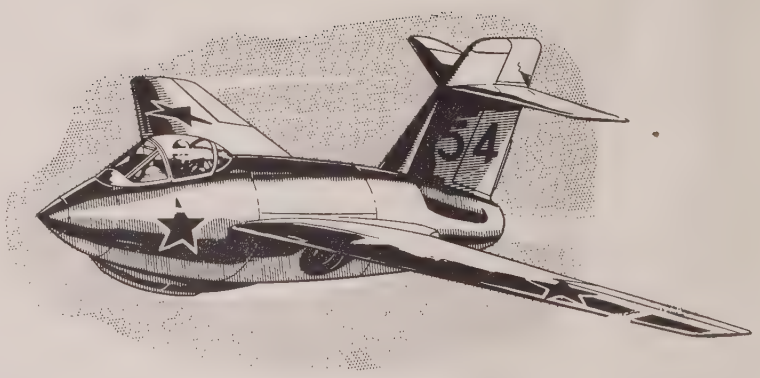
TWIN-JET fighter now in Red service in quantity is this La-15. Top speed is believed to be 520 mph at 20,000 feet

SOVIET interceptor of advanced design and in service is this MiG-15. Opinion indicates it can out-maneuver F-86



put to the reader in this article.

Technically, the Soviet Air Force finished the war at least five years behind the air forces of both her allies and her enemies. Its airplanes were strictly functional and its role, unlike that of the USAF and RAF, was primarily tactical. Not once did the air war on the Eastern Front produce a situation in which the Reds had to do full-scale battle on fairly equal terms, flying their latest equipment against the best that the *Luftwaffe* could show. Throughout the war the Soviet used neither jet fighters nor block-buster-carrying long-range bombers; she had no developed radar, large rockets or radio-controlled missiles. Because her air force was not modern, in the strict sense of the word, but rather relied on weight of numbers to bludgeon her enemy from the sky, we can gage very little of how the Soviet Air Force would have shown up opposed to carefully balanced, finely equipped formations such as the USAF and RAF employed.



YAK-21, called "target-defense" interceptor, may be rocket-propelled plane that Russians claimed has flown at speeds greater than Mach unity

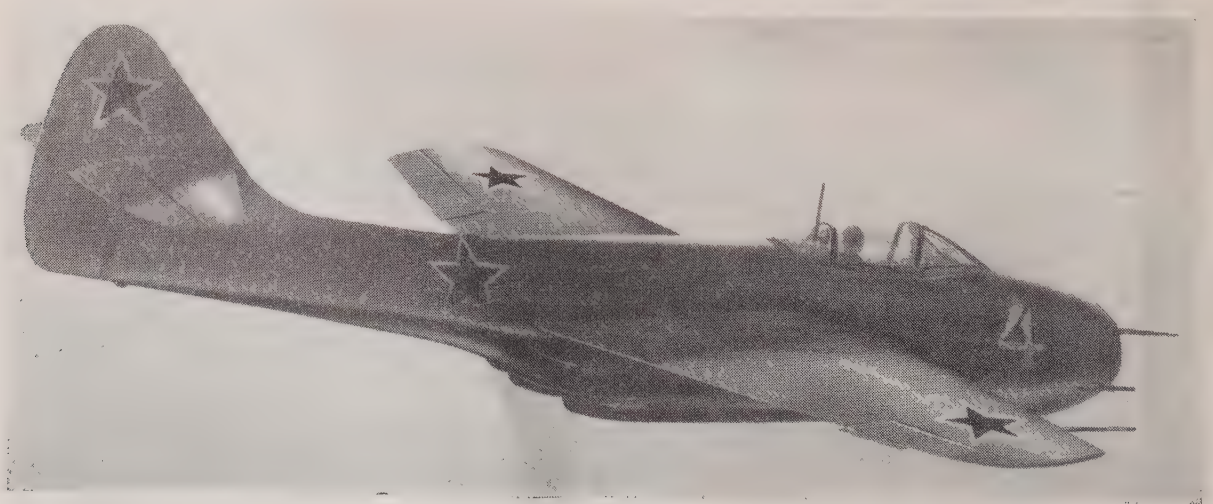
The gap in superiority, on any score but weight of numbers, in 1945 was widely in favor of the Allies. Unfortunately, this gap was discerned by the Soviet and in the last five years all her tremendous resources have been devoted to achieving aerial parity if not superiority.

Fortunately for Stalin and the *Politburo*, the legacy of modern weapons from the *Luftwaffe* was immense. Not only were hundreds of examples of Germany's latest aviation wares acquired, but the equipment and the technicians with the "know-how" to increase their effectiveness were likewise inherited. We can accept the word of Lieutenant Colonel Grigori Alexandrovich Tokaev, late of the Soviet Air Force's investigation staff in Germany, that the Russians acquired samples of about everything that the Germans had made in the aeronautical field. Tokaev apart, it is general knowledge that the leading German airplane manufacturing plants—Heinkel, Dornier, Junkers, Messerschmitt to mention but a few—disappeared East of the "Iron Curtain."

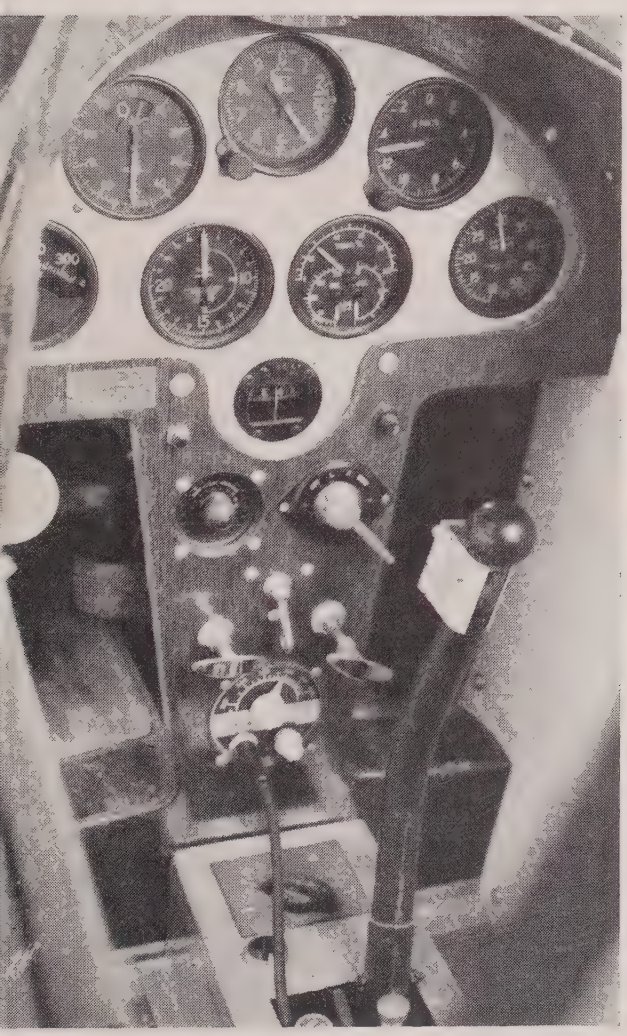
In the sphere of jet warplanes, German assistance, both practical and theoretical, has succeeded in closing the gap in the aerodynamic field at least, and it is doubtful if the USSR is now far behind the USA. Concerning ground- and air-launched rocket projectiles, Germany has furnished the Reds with the results of 10 years accelerated development work, information that has more than made up for the neglect that this form of research suffered in the USSR since 1935, when the Soviet General Staff ceased to encourage Russia's own rocket specialists such as Zander, Petrovitch, Scherchevski, Rynin, Tichof and others.

Experimental centers have been established, for example, at Irkutsk and Kuibischev where the German missiles that were still in an unfinished state at the end of the war are now being brought to operational status. How (*Continued on page 34*)

TURBOJET-POWERED MiG-9 has been in squadron service for some time. It is heavily armed, but is slower than Yak-15



MIDGET RACER designed by Neal Loving is powered by 85-hp Continental engine and has designed speed of 200 mph. Feature of the racer is an electric lap counter, shown here *(below)* in floor panel at base of the control stick



Backyard Racer

Out Detroit way, interest among pilots and plane owners is running high in a homemade midget racer designed and built by Neal Loving, part owner and operator of the Wayne School of Aeronautics at Detroit City Airport. This inverted gull-wing midget racer is powered by a Continental 85 engine, and recent flights have indicated the little plane will come up to its designed speed of 200 mph. At 5,000 feet, the plane indicates 155 mph at 3100 rpm. A stall warning indicator sounds off at 65 mph in level flight, but the ship has showed no tendency to fall off at this speed. At time of writing, no stall tests had been made. One of the features of this racer is an electric lap counter. To operate, a dial on the floor panel is set at the number of laps in a race; the pilot presses a button on the control stick each time he completes a lap; then as the plane goes into the last lap, a red light next to the dial flashes on. The plane has a wing span of 20 feet and has an over-all length of 18 feet.

Neal Loving started flying 12 years ago. In 1940, he built a successful glider which he flew in exhibitions until 1942 when he crashed in it and lost both legs. Despite the handicap of artificial limbs, Neal Loving flies his midget racer himself. The flight school Pilot Loving operates is considered one of the finest in Michigan, and its safety record is enviable.

KINETIC ENERGY, uncontrolled, did this. Train entered curve at too high a speed, left track, killing and injuring many

The Story Behind the

HEADLINES tell of pilots who ignored G's. It was pilot error that caused these accidents, and not aircraft failures

Six Die as B-25 Crashes In Hailstorm at Oakley

Plane Hits Hillside in West Kansas

OAKLEY, KAN., July 26.—(AP)—Six men were killed in the crash of a B-25 twin-engine light bomber during a violent thunderstorm nea here late today. There were n survivors.

Officers at Scott Field air bas Belleville, Ill., said the plane l there for Lowry Field, Denver.

Scott Field officers said the pla originally came from Randolph Field, San Antonio, Tex., and t names of the victims would be leased there.

Don Hall, Oakley undertaker, the plane struck in a pasture a 300 yards from the farm hom H. A. Hauschild, 12 miles soutl of Oakley.

The aircraft was torn to p Hall said, and the bodies were tilated badly. The wreckage strewn over about two acres.

Sooner Crash Kills Airman

3 Fort Sill Soldiers Parachute to Safet

ELGIN, OKLA., Oct. 15.—(U An L-17 liaison plane from the Sill artillery school crashed miles southeast of this Coman county town today after losing canopy and wing. Its pilot killed.

THREE ARE KILLED IN GRANNIS PLAN

Fayetteville Contractor, Hi Niece and Pilot Die in Co- lumbus Crash

Clarkton, Sept. 10—F

ODOM REFUSED TO FLY IN WEATHER BLAMED IN AIR CRASH KILLING 4

South Bend, Ind., June 16 (AP) —Weather which stopped a veteran pilot from flying was blamed today for a crash which took the lives of four Chicagoans.

The dead are Henry M. Kline, 42, a lawyer; his wife, Emma Jean, 39; Dr. Silas Sinclair Snider, 41, pediatrician and pilot of the plane; and his wife, Mrs. Helen Lamborn Snider, 42.

Federal investigators of the crash—which occurred yesterday in a farmyard 15 miles south of here—said the weather had stopped Bill Odom, around the world flyer, but did not deter Dr. Snider. The doctor was reported to have had 100 hours of piloting experience.

Odom had planned to travel the same course in the same type of plane, a Beechcraft Bonanza. But when he discovered thunderstorms, a cloud base of 400-700 feet, and turbulent air, he canceled

Connec Men And All Perish

By JOHN O. LEW Morning News Corresp MARION.—Three me a boy, all of Connect were killed early yester afternoon when their Bell a private plane crashed in ld about seven miles nort Marion.

e victims were identified by f Leon Gasque of Marion mes Patrick Sullivan, son, James Sullivan, of Middleb enry Sto

Publisher Killed in Plane Cra

Stanley Beauba of Hanford Dies Near Bakersfiel

BAKERSFIELD, Ma Stanley S. Beaubaire, 3 lisher of the Hanford inel, was killed instant day when his small N plane lost a wing and cra on Grisedale Ranch Granite Station, 20 northeast of here.

Investigators said Beaubair parently tried to pull his p through a fog bank and clim too rapidly. He was en rout Los Angeles on a business to have been followed by a h day in Palm Springs.

Witnesses said the plane

Headlines

All CAA-Approved airplanes are safe! But like the train engineer or the driver of a speeding car, pilots sometimes forget about those important G's

By D. N. AHNSTROM

SEVERAL years ago in an article in a national weekly magazine, Showman Billy Rose rocked his readers with the sordid fact that death was the greatest attraction on earth. The daily newspapers bear out this truth by headlining catastrophes and burying safety records in small type on back pages.

Accidents are news, whether they happen on the ground or in the air. Practically every day, readers pour over accounts of train and car tragedies, clack their tongues in distress over the mishaps, then promptly forget all about them and go right on driving their cars and riding the trains. These same readers, however, will pour over a single and infrequent account of an airplane accident, shudder at the grim report, and then vow to themselves and their neighbors that flying involves risks greater than other forms of transportation.

The obvious inconsistency in that reasoning is the direct result of a lack of understanding. People are *not* heard to say, "Automobiles are killers . . . they aren't safe. . . . I'll never ride in one!" Yet the National Safety Council's publication "Accident Facts for 1950" reports that the average passenger death rate per 100 million miles in 1949 was 2.0 for passenger cars and taxies . . . but only 1.3 for scheduled air transport planes!

In short, it's almost twice as safe to fly as to drive! Yet some fear of air travel persists. This fear stems from a lack of knowledge or an understanding of the basic causes of accidents.

Newspaper accounts of air tragedies aid and abet, perhaps unwittingly, this lack of understanding and the subsequent fear of flying. In the illustration on page 14, a news clipping gives an account of a publisher who lost his life when his plane lost a wing and crashed. Another clip tells of a contractor and two others who met death when their plane lost its wings and crashed.

To the layman-reader, there was only one cause in those accidents: the airplanes simply fell apart.

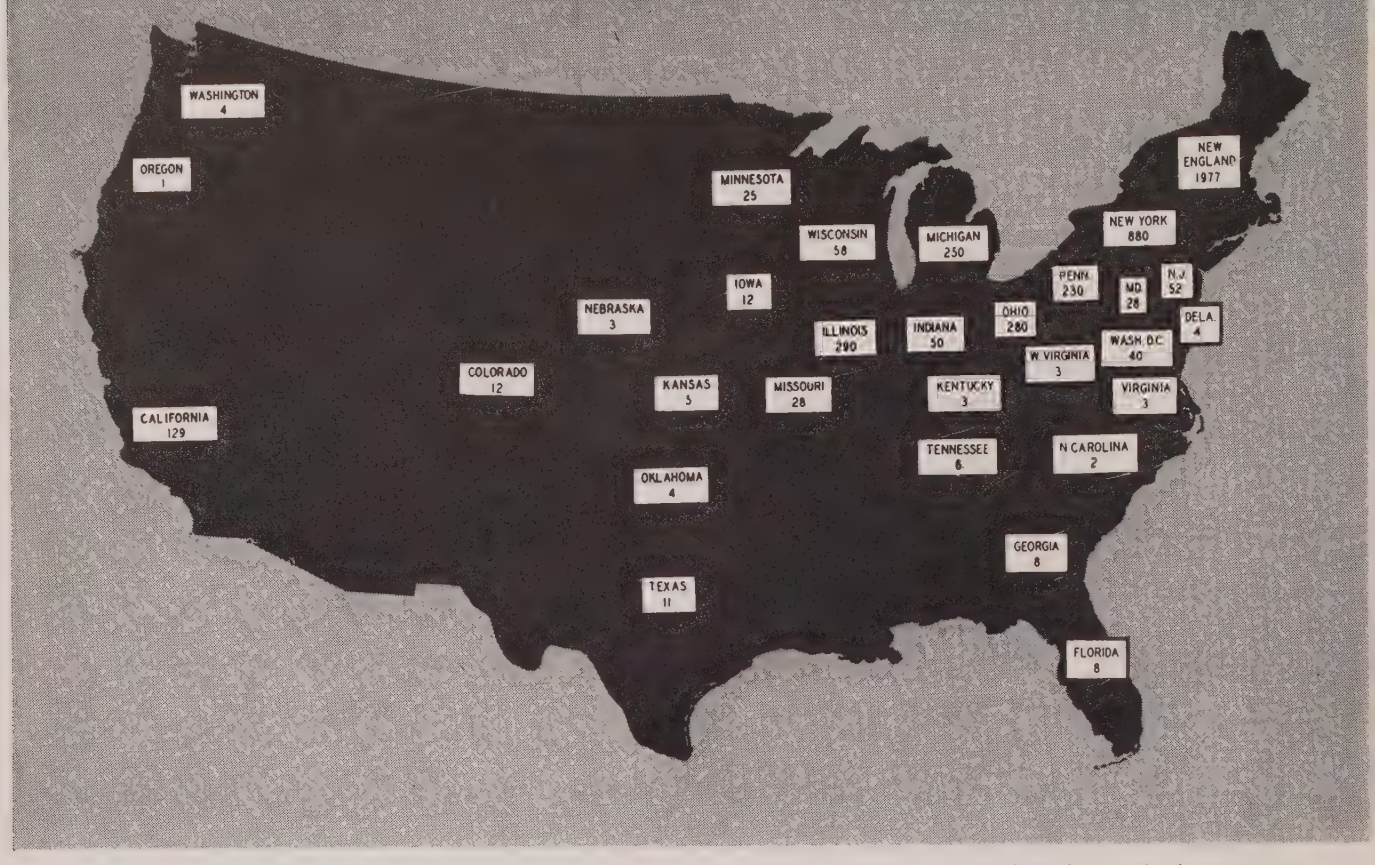
"Planes just aren't built safe," says the impressionable reader without reason. Then, when this same reader reads of death in a skidding or overturned automobile, he shrugs and mutters something about the ". . . . . damn fools that drive these days."

Yet the causes of both type accidents, in the air and on the ground, are the same. The basic laws of gravity, kinetic energy and engineering apply to all types of vehicles: trains, cars, planes . . . and kiddicars.

When a railroad engineer disregards the rules of the road and enters a curve at a speed above the "never-exceed" speed for that particular curve, the train will leave the track. This is because the steel rail cannot resist the excessive kinetic energy (which tends to keep the train going straight ahead) of the train. Therefore, the train leaves its course and is piled up and destroyed by the uncontrolled application of its own kinetic energy. Accidents such as this almost always result in long death lists. Yet, after reading of such accidents, none of us give up riding trains because of fear.

AUTO DRIVERS, over 30,000 a year, ignore law of motion. In this case, as in others, carelessness led to death

Many times we have seen the effects of uncontrolled kinetic energy as it applies to automobiles. None of us, however, gives up driving or refuses to ride in the particular make of car that might have been involved in the mishap. Instead, we understand the basic cause of the accident and realize that it is the result of one fact and one fact alone —the poor judgment of the man behind the wheel. Certainly, the manufacturer of the car, the builder of the train, or the maker (*Continued on page 52*)



SUBCONTRACTING is profitable to 4500 firms dealing with Pratt & Whitney. Map shows number of P & W subcontractors

Selling to the Air Navy

By COL. N. F. SILSBEE

KOREA provided the shock which has brought American defense planners back to a true conception of "balanced forces"—and the result has been a new realization of the vital importance of Naval Air, Marine Ground and Air, and Tactical Air for Army. It came not a moment too soon for Air Navy. The cutbacks of 1948 and 1949 were stifling its very life.

Navy's Bureau of Aeronautics (BuAer), according to the original budget for fiscal 1951 and two supplemental budgets, now has a total of over $2.3 billion to buy some 3,350 heavier-than-air craft of all types, including fighters (F), attack planes (A), patrol bombers (PB), transports (R), training planes (T) and helicopters (H)—plus the required spare parts, powerplants electronic equipment and other instruments.

This is the first step toward putting the Air Navy in the same state of readiness as the Air Force, and to the same degree of modernization, which is planned to be practically 100 per cent.

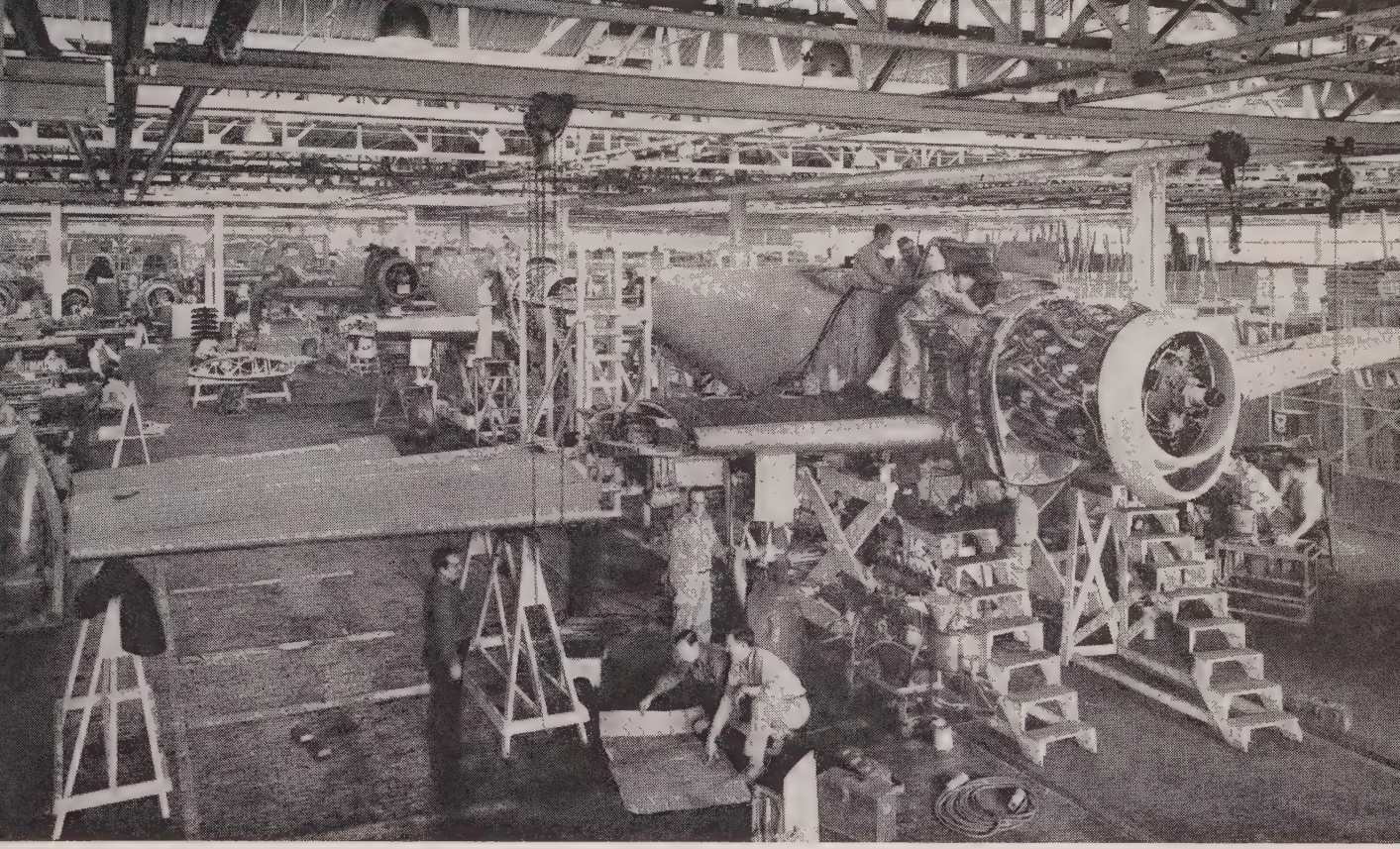
BOSS of Navy Bureau of Aeronautics is Admiral A. M. Pride

With this vast procurement program under way a natural question for companies which have never been active suppliers for Navy Department is, "How do we go about finding out just what the needs of Naval Aviation are, and how can we make known our ability to supply some of the required items?"

Naval procurement items are classified by a numerical system in categories similar to those of the USAF. Here are some of the classes of particular interest to BuAer:

Class 16: Wireless communication apparatus and parts (radio, radar, sonar and related test equipment).

Class 17: Airport and seadrome lighting, batteries, fuses, circuit breakers, switches, meters, warning devices, plugs, receptacles, lights, resistors, junction boxes,



BOOST in Navy plane procurement calls for speed-up in aircraft production. Aircraft manufacturers are hiring help again

shop equipment, and similar items of hardware.

Class 18: Photographic equipment and supplies, precision instruments, test equipment.

Class 52: Aircraft finishes, cements.

Class 65: Aircraft stoves, ranges and galley appliances for flying boats.

Class 77: Anti-friction bearings, plain bearings.

Class 80: Complete aircraft, heavier-than-air (HTA).

Class 82: Airframe assemblies, landing gear, ground-handling equipment.

Class 83: Aircraft accessories and components of hydraulic, fuel, vacuum and de-icer systems (except carburetors and pumps—see Class 86); tires and tubes, parachutes, heaters, etc.

Class 84: Complete aircraft engines (reciprocating and turbine).

Class 85: Aircraft engine parts and test equipment; special engine tools and equipment.

Class 86: Aircraft pumps and components of carburetion, ignition, starting and electrical supply systems.

Class 87: Aircraft propeller systems, including special parts and tools.

Class 88: Aircraft instruments and automatic pilots, and parts, tools, and test equipment peculiar thereto.

Class 89: General handling equipment for aircraft (preheaters, energizers, work stands, etc.).

Class 90: Aircraft (*Continued on page 37*)

PLANE ORDER, largest by Navy, is for Grumman F9F's; second largest Navy order is for McDonnell *Banshees (below)*

Radio Navigation for the Amateur

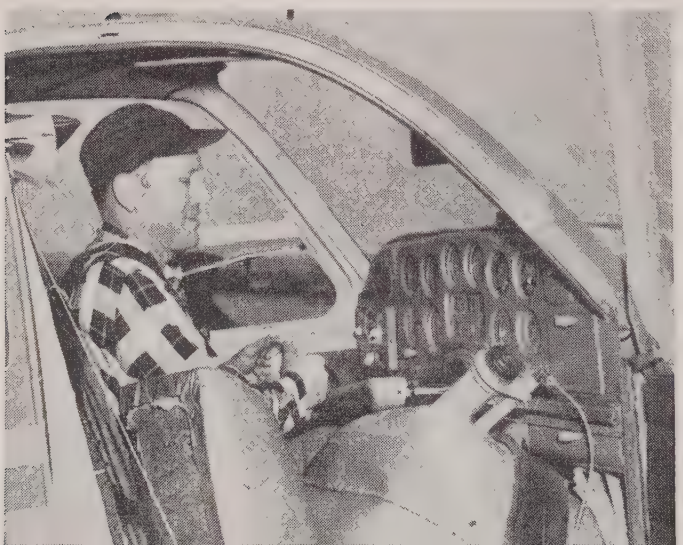
RADIO NAVIGATIONAL AIDS — LOS ANGELES-NEW YORK

STATION	FREQUENCY	STATION	FREQUENCY
RIVERSIDE RADIO	388	LOOGOOTEE OMNI	114.3
PRESCOTT RADIO	347	EFFINGHAM RADIO	215
WINSLOW RADIO	266	TERRE HAUTE RADIO	248
ZUNI RADIO	353	TERRE HAUTE OMNI	115.3
ALBUQUERQUE RADIO	230	INDIANAPOLIS RADIO	266
ALBUQUERQUE OMNI	117.5	INDIANAPOLIS OMNI	110.3
OTTO RADIO	290	DAYTON RADIO	245
TUCUMCARI RADIO	212	DAYTON OMNI	117.1
TUCUMCARI OMNI	112.3	COLUMBUS RADIO	391
AMARILLO RADIO	251	COLUMBUS OMNI	116.7
GAGE RADIO	266	PITTSBURGH RADIO	254
ENID RADIO	209	PITTSBURGH OMNI	117.3
CHANUTE RADIO	284	ALLENTOWN RADIO	320
JOPLIN RADIO	400	ALLENTOWN OMNI	117.5
VICHY RADIO	344	CALDWELL OMNI	115.4
ST. LOUIS RADIO	209	LA GUARDIA RADIO	209
ST. LOUIS OMNI	114.5		

CHARLES W. SODERSTROM, JR.

LOG SHEET used by Soderstrom listed frequency of each radio aid he used on non-stop flight across the U. S.

BONANZA had extra fuel tanks installed for the flight. Here *(above)* Soderstrom and a mechanic replace fuselage door after putting in extra tanks. Cabin *(below)* was so crammed with gas tanks, it was tight squeezo for pilot



By CHAS. W. SODERSTROM, JR.

as told to Wesley Neal

AMATEUR pilots can accomplish cross-country flight virtually as easily as seasoned airmen by following a few fundamental rules. And this is no wild theory. I have just proved to myself that it is possible.

With less than 1,000 hours of air time to my credit, I took off from Los Angeles and headed for New York. Flying solo in a Beechcraft *Bonanza*, navigating mainly by my radio compass and omni-range receiver, I landed at La Guardia field some 16 hours later. The book says that I set a new world's non-stop speed record for this class of airplane between these cities. But as a private-flying enthusiast, I am more thrilled with the prospects that other avocational aviators may do the same thing. Whether flying from Palm Springs to Philadelphia or going on a week-end jaunt to Aunt Myrtle's, radio may well become the chief means of navigation for aerial novices. Take the last leg of my trip from Pittsburgh into New York, for example.

A glance at the map shows a veritable maze of rivers, towns, racetracks, factory chimneys, etc. along this route. Certainly the area is not wanting in check points. To the average amateur who, like myself, has been rooted in the school of pilotage, such a situation can be more confusing than helpful. Disregarding every little hamlet, though, I tuned in New York. Down the slot I flew clean as a whistle.

PRE-FLIGHT of the *Bonanza* included a test run to see if gasoline dumping system would work. This air photo was taken on that test hop, shows how well the system operated. Fortunately, Charles Soderstrom did not have to use it

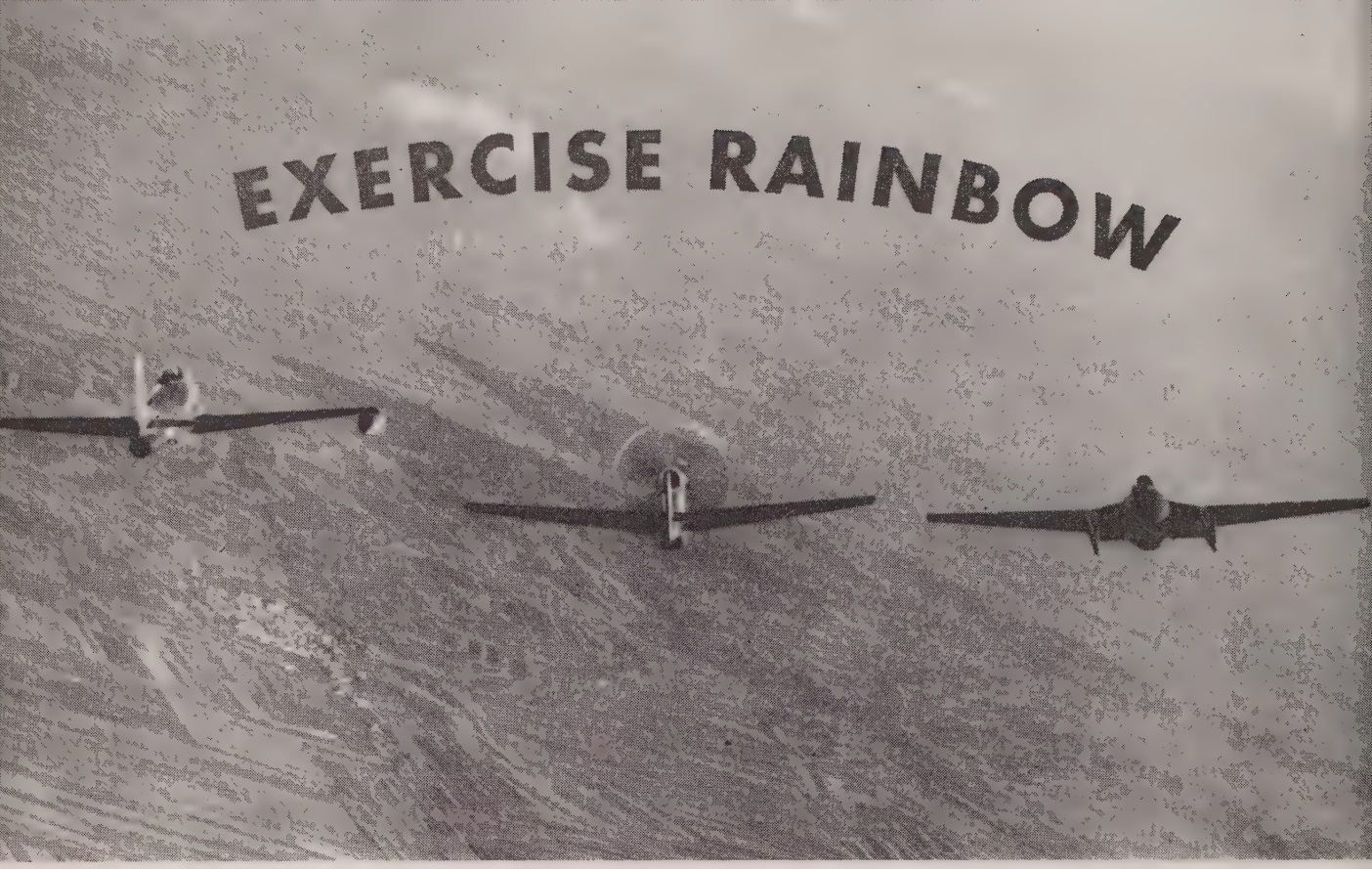
So far, my comments may seem sufficient to turn veteran navigators grey. I realize my remarks should be qualified. Radio navigation is *not* perfect. Nor is any other type, for that matter. A practical understanding of the advantages and limitations of navigating by radio, however, will provide any private flyer with enough know-how to do a creditable job of cross-country traveling. Provided he doesn't forget that he is an amateur. Failure to remember this can spell trouble in any branch of aviation; whether it be navigation or simple take-offs and landings. Let me pass on to you a few rules and precautions which I have found to make radio navigation simple and delightful.

First is the matter of weather. When it is bad, an amateur has no business trying to do any kind of cross-country flying. Certainly not by means of radio. The same static that spoils the jokes of your favorite fireside comedian plays hob with radio headings and course directions. In my record attempt I consulted Dr. Krick and his weather prophets in Pasadena. As I was shooting for a world mark, I felt that the extra expense was justified. And money well-spent it was. The perfect weather which Dr. Krick predicted for me came off exactly as forecast. Not equipped with such meteorological data, I'd take no chances with the weather. After all, there are certain elemental laws which even a good radio cannot supersede. Under such conditions, I'd lose no time in "setting 'er down." If this rule were followed, I am sure no one could ever blame radio for letting us down when the set statics up.

Another important requisite is to maintain the radio equipment in perfect condition at all times. This statement may seem (*Continued on page 40*)

PILOT SODERSTROM at controls, the *Bonanza* was weighed-in just prior to non-stop hop from Los Angeles to New York

EXERCISE RAINBOW



SYMBOL of joint operation in Exercise Rainbow, fighter planes of U.S., France, England *(above)* sweep over German countryside. Commanders were *(below, left to right)* Gen. Handy, EUCOM, Maj. Garot, France, Lt. Gen. Cannon

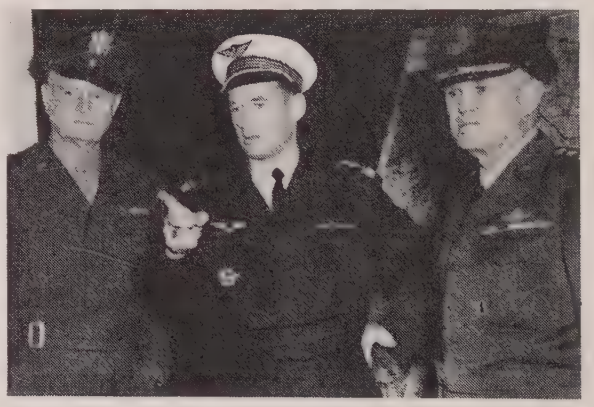
From USAFE, Special to Skyways

During "Exercise Rainbow" the joint Army-Navy-Air Force fall training maneuver of the European Command, units of the United States Air Forces in Europe (USAFE) participated in the most closely coordinated large-scale air-ground maneuver to be conducted by U. S. Military Forces in Europe since the end of World War II.

Exercise Rainbow was staged in the U. S. Zone of Germany from September 11 to September 18. The maneuver consisted of three operational phases: (1) an "Aggressor" attack from the east, (2) the withdrawal of U. S. Forces to a defensive position east of the Rhine River and the re-groupment of forces for (3) an attack in force by U. S. Forces designed to push the "Aggressor" back to his "Homeland".

USAFE air elements were charged with providing air support for both the U. S. and Aggressor Forces. This included tactical air-ground support, interception, escort, airlift and paradrop of personnel and supplies, and the operation of an aircraft control and radar warning network.

Controlled from a joint headquarters at Heidelberg, Germany, the air operations for the exercise were under the direction of Lt. Gen. John K. Cannon, commanding general of USAFE and deputy director for air, Exercise Rainbow. General Cannon, one of the Air Force's most adroit authorities



DEFENDERS' jet F-80's roar down to attack tanks of the invading "Aggressor Army" during joint maneuvers

on tactical air operations, commanded the U. S. 12th Air Force and the Mediterranean Allied Tactical Air Forces, which included all Allied Tactical Air Forces in the Mediterranean Theater of Operations during World War II. He was responsible for planning, organizing, and implementing all air operations for the invasion of Southern France in August, 1944. He has commanded the Air Forces in Europe since October, 1948, and previously commanded USAFE from May, 1945, to April, 1946.

Air participation in Exercise Rainbow began a day before the actual start of the maneuver when 27 C-82 *Packets* of the 60th Troop Carrier Group airlifted an entire battalion of U. S. Army troops with equipment from Trieste to Rhein-Main Air Base to take part in the exercise.

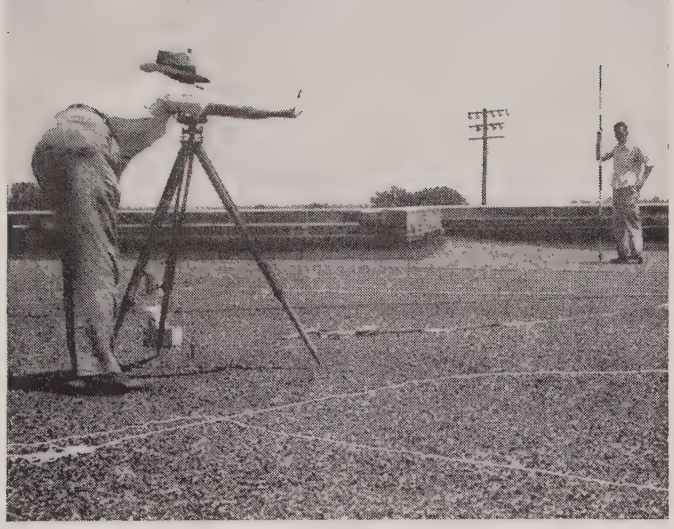
From the outset of the maneuver until completion of the second phase, the Aggressor Air Force enjoyed air superiority. The entire 86th Fighter-Bomber Group, equipped with F-47 *Thunderbolts,* and two fighter-bomber squadrons of F-80 jets of the 36th Fighter-Bomber Group, were used by the Aggressor Forces. These units operated from air bases at Munich and Furstenfeldbruck. Their strikes were aimed primarily at harassing the U. S. Ground Forces withdrawing to the west, taking a heavy toll of the Defenders' tanks, and other mechanized equipment.

For the first time during a large-scale U. S. training maneuver in Europe both the British Royal Air Force and The French Air Force placed a squadron of tactical aircraft under the direct operational control of the U. S. Air Commander for the duration of the exercise.

U. S. Forces in the air during the first two phases consisted of one squadron of F-80's of the 36th Fighter-Bomber Group, operating from the autobahn (highway) near Kaiserlautern; RAF Squadron 16, using British *Vampire* jet fighters, operating from Rhein-Main (*Continued on page 40*)

USAF PLANES flew 450 missions comprising 2,000 sorties during maneuvers. For first time, air and ground units of British, French forces joined with American units in maneuvers. The RAF units flew jet *Vampires*

PACKETS of 60th Troop Carrier Group airlifted entire battalion of U.S. Army troops with equipment from Trieste to Rhein-Main Air Base day before start of maneuvers. The 60th TC Group also made simulated paratroop drops



SURVEYOR transit is used to find exact direction to airport for layout of airport symbol: circle, arrow, mileage

Air Markers are Insurance

By GERTRUDE MORAN

"WE WERE almost among the missing until we saw an air marker at Glover, West Virginia," wrote Louise Millican, Washington, D. C., pilot after flying an *Ercoupe* to Texas on her first long cross-country. The ink was not then thoroughly dry on her private license.

While air markers have been particularly helpful to the new pilot, many experienced pilots also have been helped by them. The June, 1950, issue of SKYWAYS told of two Indiana National Guard pilots, flying a training mission last winter, who couldn't get into Logan Airport at Boston because of heavy snow. They spotted the Revere air marker and landed their fighter plane at the Revere Airport, with less than 15 minutes gas supply to spare.

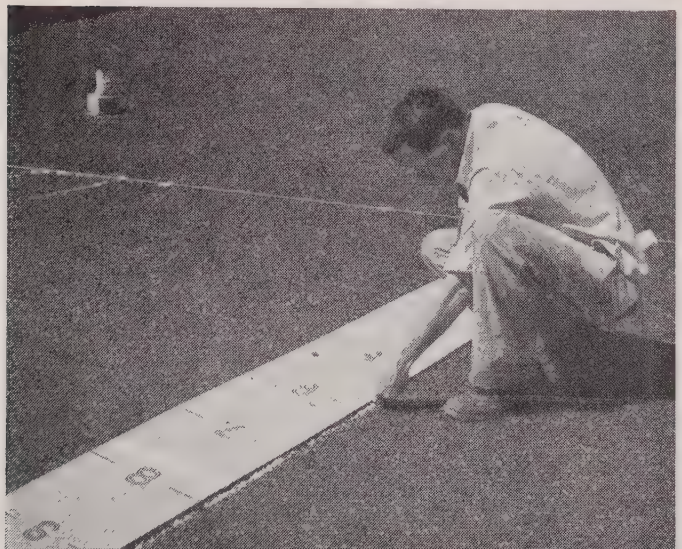
Jose Iturbi, the pianist, wasn't as lucky as the Indiana guardsmen. Flying his small plane to a concert engagement in Baltimore, Iturbi became lost and low on gas near Wye Mills, Maryland, where there is no air marker. He made an emergency landing in a corn field. Nobody was hurt, but there wasn't a concert in Baltimore that evening.

Air marking was started spontaneously in the early 30's by a few pilots who put up crude signs as guides for themselves. Soon the Civil Aeronautics Administration recognized the need for uniform markers. A low-cost standard marker was designed to give the pilot necessary directions. Between 1936 and 1941, 30,000 markers were installed throughout the country by WPA labor using $1,327,435 appropriated by Congress, and paint supplied by the states.

Soon after Pearl Harbor, all markers in coastal areas were ordered obliterated for safety reasons, and others soon faded and fell into disuse because of wartime restrictions on private flying. During the war, however, Air Force officials requested that markers be restored near training bases, to keep their student pilots from getting lost.

After the war, air marking had to start over again, and almost from scratch. Since 1942, Congress has given only one appropriation—$100,000 for 1947. This was apportioned to the states on a

STRING is laid out to mark top, bottom of letters; then letters are laid out, strokes outlined in kitchen flour



BASE COAT of aluminum paint is then sprayed on marked-out letters. Workers use sheets of cardboard as stencil

matching basis, marker for marker. At present there are no Federal funds for air markers. It is up to the states, or to organizations, flying clubs and individuals.

Eighteen states have funds from their legislatures: Alabama, Pennsylvania, Michigan, South Carolina, Virginia, Connecticut, Massachusetts, Wisconsin, Nebraska, Tennessee, Idaho, Oregon, Montana, Indiana, New Jersey, Oklahoma, North Dakota and New York.

Among the organizations and firms to install markers are the Civil Air Patrol, Flying Farmers, Kiwanis Clubs, Jr. Chambers of Commerce, and Standard Oil Company. The Ninety-Nine Club has air marking as a national project this year and has installed numerous markers throughout the country.

Blanche Noyes, Chief of Air Marking with the CAA, has put up an air-marking trophy which rotates each year to the unpaid individual who is responsible for the most installations. In 1946 it was awarded to Mrs. Gladys M. Snyder, and in 1948 to Mrs. Ruth Shimon, both 99 Club members; in 1947, Col. Jesse Dobbins of the Civil Air Patrol received the award. The 1949 award has not been made as yet.

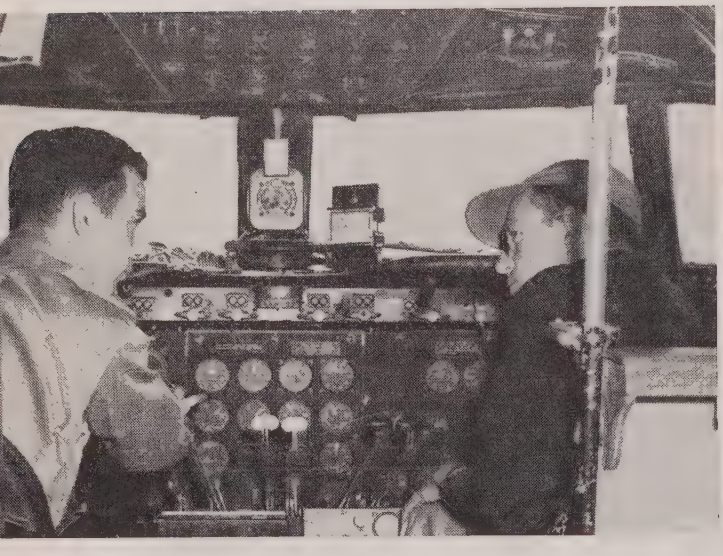
The vast majority of markers have been installed by State Aeronautics Commissions. Primarily as a result of the Commissions' efforts, there are now 7,000 air markers. These (*Continued on page 38*)

FINISHED AIR MARKER at Fairfax, Va., looks like this. Airport symbol indicates 15 miles to Washington National Airport

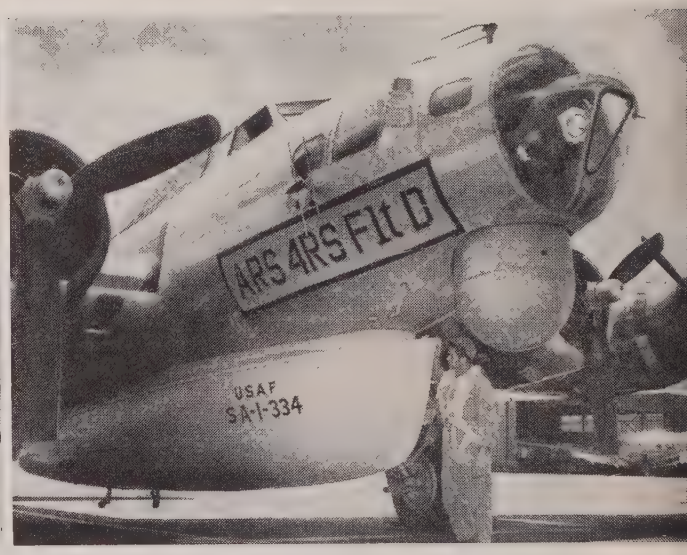
CHROME yellow binder paint is put on over aluminum base coat after the base coat has been allowed to dry thoroughly

GLASS BEADS are then sprinkled on the wet chrome yellow paint by hand. Bead distribution is more uniform that way

Tokyo Airlift



AIRLIFT CAPTAIN Ed Pinke of Flying Tiger Line and co-pilot Don Downie shoot the breeze before take-off to Tokyo



GUARDIAN of the Pacific is the Air-Sea Rescue Unit of the Air Force. This SB-17 operates out of Hickam Field, T.H.

By DON DOWNIE

TOKYO: This Pacific Airlift is a 13,000-mile relay race—with 35-ton batons.

Just as soon as an airlift plane lands, the fuel tanks are filled and a fresh flight crew climbs aboard. It's similar to the old stagecoach days when the passengers and cargo went straight through and the drivers and their horses stopped for a rest.

You can't write the real story of an airlift like this from an operations office or from riding in the back of an airplane. Unless you're up on the flight deck with the crew, you don't know what's going on. That's the reason SKYWAYS asked the Flying Tiger Line to sign me on as co-pilot for a regular DC-4 run from Burbank, California to Tokyo.

For a flight to Tokyo you need an instrument rating on your commercial license, a current physical, a passport and a flight check in a C-54. Then you're headed west over that big puddle, the Pacific Ocean.

Chief Pilot of the Flying Tigers, John Long, gave me a flight check on a Saturday. Monday night we took off for Tokyo with an equipment check as a C-54 co-pilot in our pocket.

"It's just like any other airplane," said Mr. Long as we climbed up the 20-foot ladder into the cockpit of the DC-4. "You push in one of the rudders and it turns—just like a *Cub*."

It's an awe-inspiring sight, that first glance of the cockpit in a DC-4. Levers, gages, wheels and gadgets overflow the spacious flight deck. "How am I ever going to learn all this procedure? Maybe this time I've taken on more than I can handle!" I groaned.

It had been six years since I'd flown anything bigger than a twin-Beech. One of the nicest wrinkles in the cockpit of the DC-4—and an item that might well be copied by lightplane builders—is a check list on a long, lighted scroll. If you religiously follow the procedure on that check list, the DC-4 will almost fly itself.

Anyhow, we passed the check and met our Tokyo companion at Burbank two nights later. Edgar Pinke of Denver, Colorado was the left-seat Tiger pilot. He had been an instructor at the Air Force C-54 school at Homestead, Florida, so checking out green transport pilots in a four-engined Douglas was nothing new to him.

"By the time you're in Honolulu," he said as we boosted our bags up the ladder into the crew compartment, "you'll know where everything is located."

"There's little or no weather over the Pacific," said Ed as he filled out a flight plan. "I made the first two trips for the Tigers on the northern Great Circle run. There's plenty of weather there, but on the last trip over this route I flew only seven hours on instruments—out of a total of 72 hours."

Our first hop, from Burbank to Fairfield-Suisan AFB, took an even two hours. The weather was clear over Airway Amber One, but thunderheads and lightning dotted the sky over the direct route, Airway Blue 46. It took that full two hours to find all the gages and ask how they worked.

That airplane went right out for Honolulu as soon as it picked up a passenger load at Fairfield. However, Ed Pinke and (*Continued on page 26*)

CABIN of the big C-54 carried troops in full battle equipment. Destination: Honolulu and eventually Japan or Korea

PACIFIC DIVISION AIR ROUTES MATS

I stayed over there at Fairfield to pick up the next DC-4 going through.

This airlift is a big operation—the biggest thing since the Berlin Airlift. Regardless of where it goes —to Tokyo or Timbucktoo, the operation is basically the same. In a recent speech, Major General Laurence S. Kuter, Commander of MATS, released the following statistics: 66 planes from the civil airlines, scheduled and non-scheduled, are flying the Pacific Airlift; 17 different airline companies furnished a total of 63 DC-4's and 3 Boeing *Stratocruisers*. Our DC-4 from the Flying Tiger Line was just one of the 66.

Three different routes are being used in this airlift: military planes fly from Fairfield to Honolulu, Johnson Island, Kwajalein Island, Guam and then to Japan—a total of 8,083 miles in roughly 40 hours. Some contract carriers and other military planes fly the Great Circle route from McChord Field near Tacoma, Washington to Anchorage and then out along the Aleutian chain to Shemya and then Tokyo. Civilian carriers, including the Tigers, fly the mid-Pacific route from Fairfield to Hawaii, to Wake Island and Tokyo, a total of 6,718 miles in 34 hours flying time. Distance is always measured in time—at 200 mph, and 200 gallons per hour.

When the next "baton" (. . . the DC-4 we were to fly) in this relay race arrived from Burbank, it was re-fueled and loaded with passengers—troops in full battle equipment. The cavernous gas tanks were filled to just over 3,000 gallons and we taxied out for take-off. Destination: Honolulu.

The afternoon was hot and our DC-4 took a substantial roll in breaking ground. The gear came up and Captain Pinke headed westward. We climbed to 8,000 feet and leveled off.

In the crew compartment the other two members of our flight staff were busy at work. Navigator for this complete flight was Blair Johnston, a veteran in Pacific flying. Between Tiger flights, Johnston is a combination navigator-radio operator with the San Diego Tuna fleet. Our radio operator was Don Tyson who spent eight years with Panagra in South America.

NAVIGATOR on the C-54 flight to Tokyo was Blair Johnston

One check that the Tiger pilots make when they level off and set the big DC-4's up for cruising flight is a test of the gear-up locks. Should these locks fail, the landing gear would drop into the extended position and you'd never make land if it happened near the midpoint of your flight.

Navigator Johnston brought out his computers and went to work on the "how-goes-it" chart. That's the graph of the progress of the flight that will show at a glance the point of safe return and the point of no return. Just before take-off, Johnston stuck a little tab of paper on the throttle console with the magnetic compass heading. Then, after each hourly "fix" with the sextant or Loran (Long Range Navigational aid), he would alter that heading by perhaps a single degree to keep the ship on course.

You've heard of shadow boxing, but did you ever hear of "shadowing the propellers?" On any multi-engined airplane the engines must be kept running at the same rpm or a disagreeable throbbing beat will develop that is very annoying to both passengers and crew. The plane we had on this first hop was an old DC-4 with two million miles on the log books and it didn't have an electric "synchroscope" to harmonize the four engines. Captain Pinke showed me how to set up the props by sight. The engines are matched in pairs: number one and two on the left and three and four on the right. If the left pair of engines are turning at slightly different speeds, a shadow between (*Continued on page 39*)

RADIO OPERATOR was Don Tyson who spent eight years with Panagra in S. America. He and Johnston are Pacific vets

VISIBILITY over the nose and out the sides is one of the features of two-place pusher-type Anderson Greenwood 14

New on the Market

With the CAA's certification of the AG-14 in hand, builders of the Anderson Greenwood Model 14 are going ahead with plans to market the new two-place lightplane. Pusher powered by 90-hp Continental engine, the AG-14 has a top speed of over 120 mph, a cruising speed of more than 110 mph and a range of four hours. At gross weight and with flaps down, the new two-placer stalls at 57 mph, and has a landing speed of about 50 mph. The two-position flaps give the plane a very steep glide angle. Baggage compartment is stressed to carry 250 pounds of baggage or cargo. Estimated price of the pusher AG-14 will be about $4500, fully equipped with two-way radio, etc.

BAGGAGE compartment carries 80 pounds but is stressed for maximum 250

WINGS are "washed out" at the tips so that in stall inboard portions of the wing go first. Tests prove plane to be extremely spin resistant

Ready for Winter?

Winter flying can be fun or futile—safe or dangerous. It is up to the pilot. Smooth air and the absence of thunderstorms during cold weather set up ideal flight conditions, but lower air temperatures, depending upon the minimums encountered, demand a complete revision of standard operating procedures. Failure to observe these revisions can and often does lead to trouble.

Any pilot contemplating cold-weather flying should first analyze conditions under which flights will be made. If certain schedules will have to be maintained, if there is a time element connected with his flying that will demand taking to the air regardless of weather conditions, preparations will have to be much more complete than in pleasure flying when milder weather can be selected.

There is no set of cold-weather rules that will apply to all lightplanes. Some require one type of modifications, some another. But there are generalities which occur in all instances and offer sound guidance in making preparations for cold-weather flight. These generalities should be used in conjunction with manufacturer's specifications when they exist to make sure that no point has been overlooked in engine or airplane that will be affected by below-freezing weather.

Cold-weather engine operation need not be a serious problem though it invariably introduces certain inconveniences. To begin with, the engine should be in first class condition before cold weather sets in. This will eliminate operating problems caused by inferior engine performance. Secondly, following the manufacturer's specifications, the engine should be completely "winterized" before the first cold-weather flight is made.

In general, engine winterization consists of draining summer oil (SAE #40 or #50) while the engine is hot and replacing it with the recommended cold-weather oil (SAE #20 or #30). Use only standard brands of oil with a guaranteed viscosity index. Many cheaper light oils become "watery" at operating temperatures and lose much of their lubricating properties. Money spent for good oil is an economical investment in dependable cold-weather operation.

In some installations, it is advisable to cover exposed oil tanks and oil lines. This will make it easier to maintain the oil above minimum operating temperature. If extensive winter operations are planned, an out-going oil-temperature gage should be installed to supplement the in-coming temperature gage with which most lightplanes are equipped.

Magnetos should be inspected and carefully adjusted prior to cold-weather flight. This should be accomplished by a licensed mechanic. Ignition wires should be inspected for insulation cracks and for tightness of all connections, and spark plugs should be in good condition with sound porcelains. A "fat" spark is a prime requisite in cold-weather engine starting.

Sometimes engine-cowling changes will be effective, but these should be carefully engineered. Even a slight change in cowling design may cause poor heat distribution. When changes are made, most operators have obtained best results by slightly restricting the exhausting air openings.

Winterizing the airplane, much like the engine, consists mostly of lubrication problems. Oils and greases that will freeze or (*Continued on page 44*)

WARM UP engine of *Bonanza* in winter until head temperature is 300°F. Throttle should be set at 1,000, 1200 rpm

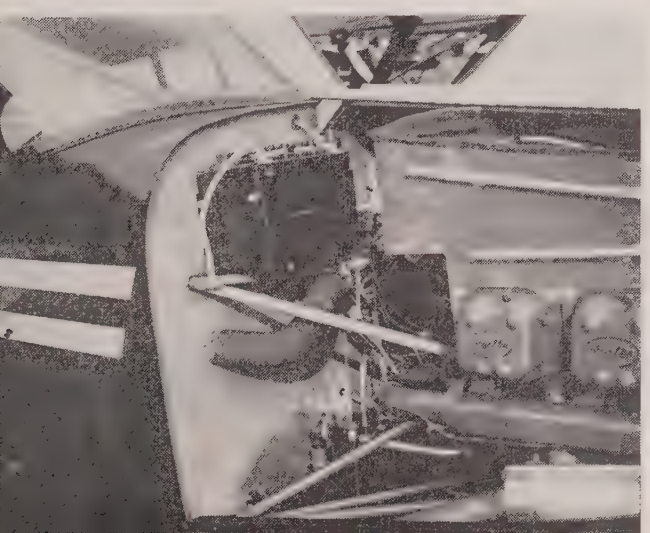
NOT S.O.P. but successful once. Pilot took off on pontoons from snow-covered ice of Seattle's Lake Washington

LANDING in very cold weather calls for extra precautions: sufficient power should be left on during glide to maintain cylinder head minimum operating temperature. Graphite can be used on links of retracting mechanism *(below)*

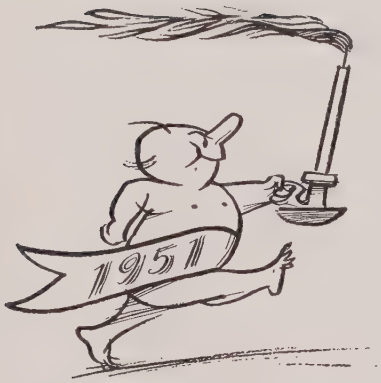
It's strictly up to the pilot to make winter flying fun or futile . . . . safe or dangerous

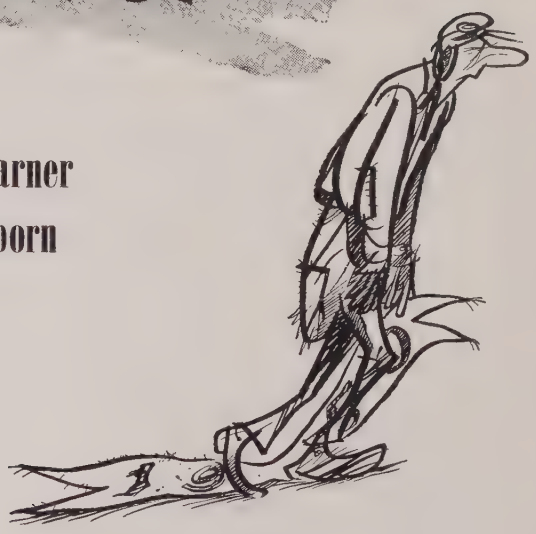
By GILBERT C. CLOSE

BATTERY OUTPUT during cold weather can drop more than 50 per cent. Slow heating will restore battery strength



DILBERT





By S. H. Warner and R. Osborn

Taxi Responsibilities—After completing night landing practice, Dilbert was taxiing to the line when he chewed up another airplane which had stopped on the taxi strip because of a broken landing gear.

Investigation brought out the fact that there were several people jointly responsible for this accident.

1. The pilot of the damaged airplane: Had he remained near his plane to warn approaching traffic, the collision could have been prevented.

2. The tower personnel: They could have averted the accident by notifying incoming pilots of the crippled plane, or by closing that particular taxi strip until it had been moved.

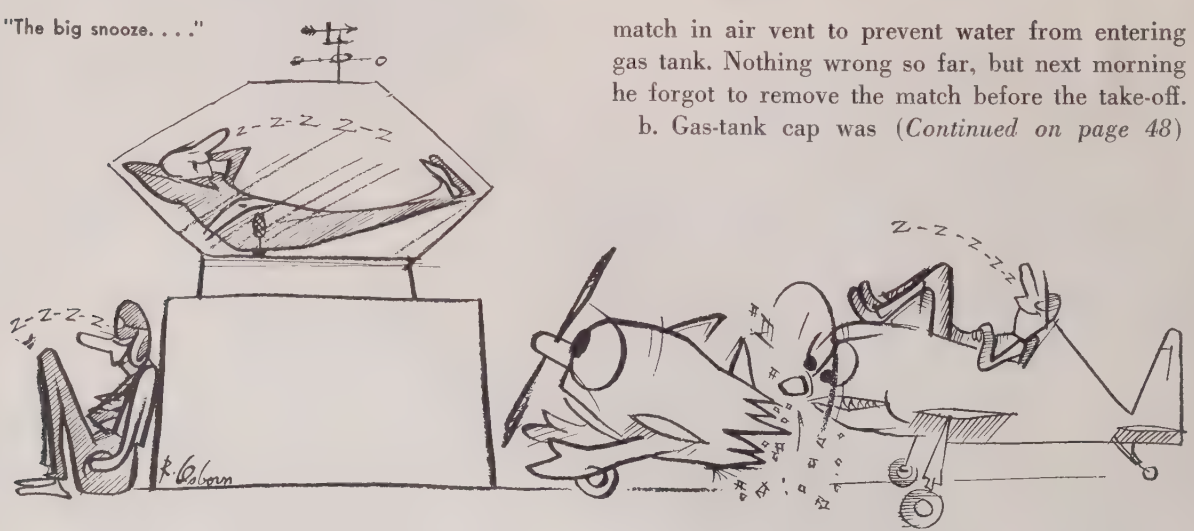
3. Dilbert. No matter what the extenuating circumstances, a pilot *always* has final responsibility for safely taxiing his airplane.

Clogged Vents—You wouldn't think such a little thing could be so important, but when that gas-cap vent gets clogged, brother, your flight is about over. Granted it doesn't happen very often, but here's the fill-in on a few mysterious accidents:

a. Weather man predicted rain. No hangar space available. Pilot staked out plane and carefully stuck match in air vent to prevent water from entering gas tank. Nothing wrong so far, but next morning he forgot to remove the match before the take-off.

b. Gas-tank cap was (*Continued on page 48*)

"The big snooze. . . ."



Behold . . . a dope! Dilbert stays on VFR while the weather goes IFR

CAOA REPORT . .

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. The CAOA headquarters are located at 444 Madison Avenue, New York 22, N. Y.

Air-to-Ground Radiophone

Enough of the radio-telephone questionnaires *(see CAOA Report, December)* have been received at CAOA Hq. to arrive at a preliminary evaluation of "Operation Radiophone." Here are some of the figures, together with a summary of opinions and a few typical comments.

Combining the replies from CAOA members with those from non-member companies, we have found that the percentage of executive aircraft equipped for ship-to-shore radiophone service was a surprisingly high 48 per cent. Sets were mostly Collins or Bendix radio transmitters and receivers.

About 87 per cent reported that the present Marine service was unsatisfactory. A few, however, said that it was adequate for their particular needs. Main complaints were: Channels too busy, too much static, too little range, and too little coverage of country as a whole; service was spotty—in some places fair, others hopeless.

Over 90 per cent favor a special aviation service in the UHF band, with nearly 40 per cent definitely enthusiastic.

For example: "Our company officials and I have discussed this many times and are one thousand per cent for it. It would add greatly to the utility of our aircraft."

Another: "As we have plants in all sections of the country, and as our executives are moving from plant to plant, it is important that our planes and the passengers aboard be in telephonic communication as much as possible. It has been our experience over the last two or three years that the Maritime ship-to-shore service is very inadequate. We find that except under extremely good radio conditions, communication is impossible."

Some suggestions for immediate action include efforts to have more channels allocated to the important Los Angeles (San Pedro) station (aircraft almost never get through); get FCC to allocate more frequencies for present airborne radio equipment; see if the present frequencies used by automobiles could be extended, with the new ones made available for aircraft.

These questionnaires and letters received by CAOA are being made available to American Tel & Tel as an indication of the interest in the project displayed to date. The FCC is also being kept informed, and has stated (from an unofficial but very high-level source) their interest in the project and willingness to cooperate.

Civil Air Mobilization

The National Security Resources Board has set up a committee for recommendations concerning civil air mobilization.

Symington has named CAB Chairman Delos Rentzel as coordinating chairman of a thorough-going survey. Five study groups manned almost entirely by aviation industry men will report on January as to how the various aspects of civil aviation should be fitted into a partial or total mobilization picture.

It is expected that the recommendations will follow the pattern worked out by the CAA Aviation Development Advisory Committee (ADAC), in which the CAOA cooperated.

The five study groups of the NSRB committee are:

(1) Air Transport, under Milton W. Arnold, V-P of the Air Transport Association.

(2) Airports, under A. B. Curry, director of the Dade County Port Authority, Miami, and President of the Airport Operators Council.

(3) Airways, under G. A. O'Reilly, President of Aeronautical Radio, Inc.

(4) Training, overhaul, maintenance, under William J. Graham of the Aeronautical Training Society, and manager of Butler Airport, Pittsburgh.

(5) Private flying, under George E. Haddaway, chairman of the Conference of National Aviation Organizations (of which CAOA was one of the 15 founding members).

Cole H. Morrow, Chief Plant Engineer of J. I. Case Company and chairman of CAOA's Technical Committee, has been appointed as a member of the important Airways study group (3).

Airport Gate Improvement

Following CAOA Board Chairman W. B. Belden's talk at the AAAE convention in Columbus, Ohio, last spring, Larry S. (Monty) Montigny, Chief Pilot & Captain of Dresser Industries' PV-1, began a comprehensive survey of the more than 150 airports in the country at which he lands, from the standpoint of "gate treatment" of executive aircraft.

He has reported progress from time to time, and just recently came up with this encouraging statement: "I had my report more than three-fourths completed some weeks ago, but as I have been getting around again find that a new survey will be necessary as conditions have improved considerably. Almost every field on which I formerly had a bad report (and I told them about it!) has reformed!"

This has been confirmed by other reports from Cole H. Morrow, chairman of CAOA Technical Committee, and from Jack Jones, chief pilot of the Fairbanks, Morse B-23, whose original criticisms sparked the whole deal.

New Members

Four new members of the association have been accepted during the past few weeks. These are:

Hancock Oil Co. of California, Long Beach. This company has operated a Beechcraft D-18S since 1946; is engaged in petroleum exploration, production, refining and marketing. Mr. John Hancock is Executive Vice President, and R. F. Cenicerôs (ATR) is the company pilot.

Albert Trostel & Sons Company, leather tanners of Milwaukee, Wis., flies a modified North American B-25J and Beechcraft *Bonanza.* Tom R. Neyland (ATR) is the chief pilot, Bill Buckingham, co-pilot, and John Cunningham, co-pilot-mechanic.

Texas Illinois Natural Gas Pipeline Company is a newcomer in executive-flying operation. This company is engaged in the transmission of natural gas from the Gulf coast of Texas to Joliet, Illinois. Their Douglas DC-3 was acquired during the summer, modified by Remmert-Werner, and is now based in Park Ridge, Chicago. A Cessna 170A was purchased in October, and is based at Little Rock, Ark. A relatively high 80 hours per month utilization is reported for both aircraft. Mr. M. V. Burlingame is Vice-President in Charge of Operations, J. T. Donohoe is Traffic Manager, Harvey H. Glass (ATR), chief pilot, and Ralph W. Palmer, pilot of the Cessna.

Minnesota Mining & Manufacturing Company, St. Paul (the 3 M Co.), makers of Scotch Tape, abrasives, insulation, etc. Their DC-3 was also a Remmert-Werner job, and it went into company operation early in December. Mr. John G. Kruse is Secretary of the Executive Committee, Don Richardson (ATR) is chief pilot, and Melvin Longlet, co-pilot.

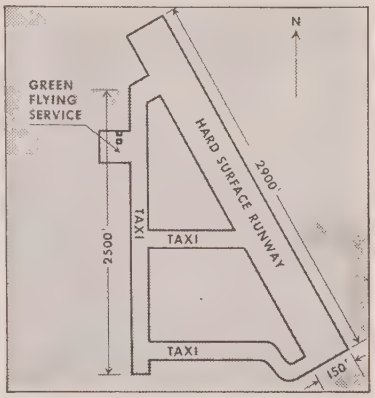
TRIANGLE on nose of A-26 is emblem of the Triangle Conduit & Cable Co., New Jersey

PLANE FAX

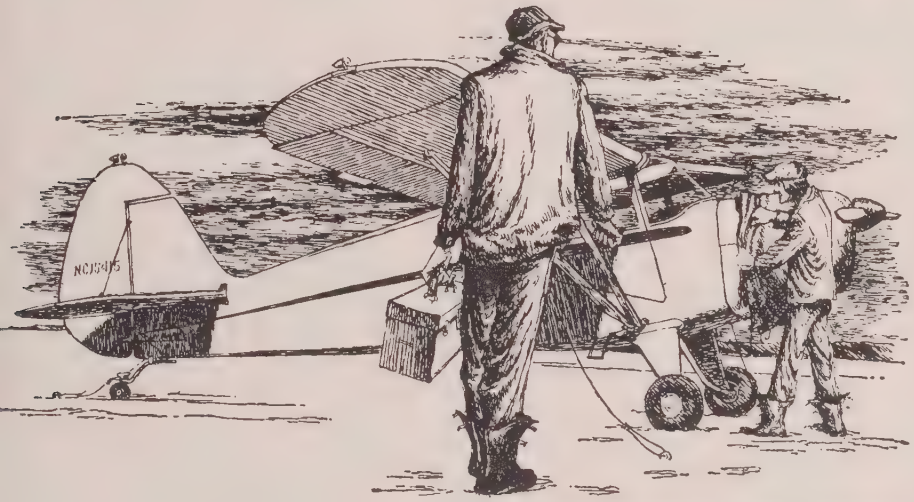
Quick picture of

EUGENE AIRPARK, OREGON

Within city limits... no tie-down fee... weather service, repair shop, chartered flights, student training... ALL STANDARD OIL PRODUCTS.



How to keep idle planes healthy

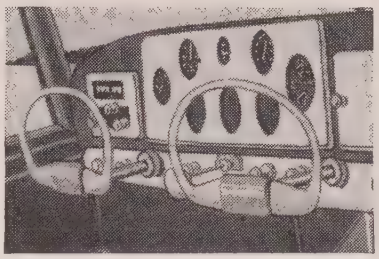


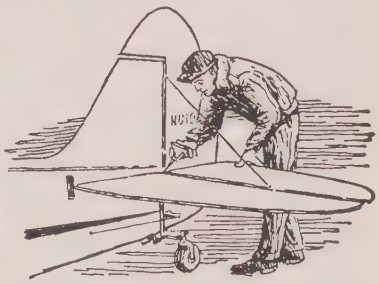
Keep engine well lubricated

"Engine trouble often follows a period of idleness," reports Max Green, owner of Green Flying Service at Eugene Airpark, "because ordinary oils run away from engine parts as soon as the motor stops. Moisture then condenses on the bare cylinder walls, causes rust and lets pistons grind and scrape when you start up again. We don't have that trouble here because all of us use RPM Aviation Oil . . . it clings to all metal surfaces, hot or cold, summer or winter."

Guard instruments against rust

"When you leave your plane out in the sun, the lubricant around your gyro and other instrument bearings can evaporate. That can lead to rust which may throw off your readings the next time you're upstairs. You can reduce this hazard by using RPM Aviation Grease No. 5."



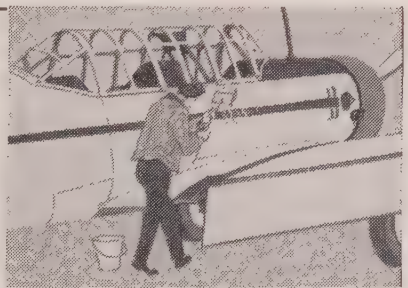


Lubricate control surfaces frequently

"Elevator, aileron and rudder hinges should be inspected and oiled even when the plane is stored in winter. RPM Aviation Instrument Oil is the ideal lubricant for all parts exposed to weather."

TIP OF THE MONTH

Clean outside surfaces often



"Mud, dirt and salt may accumulate when you don't use your plane . . . and seriously affect flight characteristics. So, it's wise to clean control surfaces, trim tabs, hinges and other parts often."

Max Green, one of the famous "Flying Greens," a family with 19,000 flight hours.

CHEVRON AVIATION GASOLINE

RPM AVIATION OIL

Standard Oil Company of California

Russian Air Force

(*Continued from page 12*)

far the Reds have been able to develop guided missiles in the last five years is problematical. Under the guidance of TsAGI, the Russians have undoubtedly produced their own versions of the Hs-298 and V-3 anti-aircraft, and Hs-293 anti-shipping missiles, and the Soviet will persevere in finding the solutions to the many problems associated with such weapons.

The Russian legacy of radar equipment was comparable to that of rocket missiles, and the cardinal question of whether the Russians can weave the results of their inheritance into an effective pattern of Soviet Air Defense is almost certainly answered in the affirmative by the recent confirmation of Russian radar-equipped night fighters.

It should be borne in mind that the *Luftwaffe* operated radar ground-controlled interception and radar air interception on the Eastern Front, and the many examples of German jet and piston-engined night fighters equipped with radar air-interception equipment gave the Soviet Air Force some useful pointers in its practical usage. The USAF unwittingly furnished the Russians with examples of radar bombing aids when three *Superfortresses* landed in Eastern Siberia. Thus the Russians have had the patterns on which to make prototype models, a task aided by the thousands of radar technicians and workers from the Telefunken and Siemens Askania plants who are now busily engaged in plying their trades at Voronezh, Riga, Khabarovsk and elsewhere.

Does the Red Air Force's latest equipment compare favorably with that of the USAF? That is another pertinent question of the day. We think that the answer is again *Yes;* and hereafter are reviewed the latest Soviet fighters, attack aircraft, light, medium and heavy bombers, in order that the reader can form his own judgment of how great is the potential menace from the Soviet Air Force.

The bulk of Russian fighter airplanes in service today are single-seaters, having design emphasis on the cardinal requirements of speed, climb and maneuverability, designed initially for operation by day. Range and ceiling have been, until recently, secondary considerations. Specialized single-purpose machines are, however, under development and considerable attention is being given to jet-propelled, radar-equipped multi-seaters, specifically for night- and all-weather fighting. Another, and even more specialized fighter type that is receiving much attention in the Soviet Union is the "target-defense" interceptor, built (like the Republic XF-91) as an insurance against the fastest and highest-flying enemy airplane operating by day.

Real danger of confusion lies in the somewhat academic attempts that have been made in the past to classify existing Russian fighters. The Russian's love of functionability makes it doubly difficult to foresee the duties to which standard Soviet fighters may be put in times of war. But although the general run of present-day Red fighters is not, in the strict sense of the term, of specialized design, many of the fighters appear to display some pre-eminent quality which prescribes their primary tactical role. Thus, the heavily loaded (to Russian standards), heavily armed MiG-9 is first and foremost a ground-attack machine and medium-altitude interceptor; the fast-climbing, lightly-loaded Yak-15, embodying the virtues that stem from low wing-loading and moderate thrust, high maneuverability and stability at altitude, is obviously most suited for high-altitude interception.

In order to define the lines along which Russian warplane development is proceeding, we will review the activities of each of the Soviet's leading airplane designers, and describe briefly the various types that they have produced since the dark cloak of secrecy first enshrouded their activities at the end of the War.

Designer of a number of jet fighters is Colonel General Alexander S. Yakolev, the youngest top-line airplane designer in the USSR. The RAF and the *Luftwaffe* were the only air forces with jet fighters in operation at the end of the war. The Soviet Air Force had none (if one discounts one or two relatively unsuccessful research machines) and wished heartily that it had. Immediately, the Russians overran a large area of Germany; they seized upon the comparatively well-tried turbojets of Junkers and B.M.W., and had Yakovlev arrange a marriage of convenience between the Jumo 004 turbojet and his well-tried Yak-9 airframe.

The result, the Yak-15, was one of the smallest and most compact jet fighters in the world, with a comparatively high performance for its time (560-570 mph at altitude) but creating an all-time low in pilot visibility. Although an inferior, makeshift design, the Yak-15 was of value in that it furnished its designer with some jet experience and simultaneously provided a much-needed morale fillip for the nation, and an implement for foreign propaganda. What happened to the morale of the pilots who had to fly it was another matter altogether. However, despite the fact that the Yak-15 was intended purely as an interim type and is popularly supposed to be out of production and relegated to training duties, it is a fact that a new, hopped-up production development, tentatively known as the Yak-15B, is now rolling off the production lines, possibly destined for satellite air forces.

As already mentioned, not least of t Yak-15's many faults was the extremely b view provided the pilot for take-off, a dir result of the haste with which the Re placed the airplane in production, retaini as many features of the Yak-9 airframe was possible, including the tailwheel und carriage. As the redesigned Russian M-0 units of increased power (basically Ju 004)—developed by Soviet jet engine expe such as Engineers Chelomey, Charomsk Loulik, Svetzin and others—became ava able, Yakovlev decided to redesign the Ya 15, and the result was the much-improv Yak-15B.

To the student of aeronautical fashi trends, the most noticeable feature of t design of the Yak-15 series fighters, inde all early Russian jet fighters, is the "droo snoot" effect of the aspiration system. T layout incorporated in these early fighte was being tried by several German concer in their jet fighters, Russian design tren having seemingly followed a parallel a possibly more successful line of develo ment.

A sturdy little machine in the best Sov tradition, the Yak-15B is not a pretty a plane, its squat appearance being the sult of mounting the jet unit in the low part of the fuselage and providing a cha acteristic pod-and-boom effect. This jet po tioning, it can be surmised, has been co sidered desirable for two reasons: 1) Wi jet unit low and empennage high, it is po sible to eliminate a long and inefficient exhaust pipe; 2) Because most Russian units have not yet been cleared for lo running times, the low set position mak the task of changing the jet unit quite si ple. An incidental advantage is that t boom-like rear fuselage is left free to hou fuel tanks.

In the new and improved Yak-15B a t cycle undercarriage replaces the tailwhe type previously fitted, the nosewheel unit tracting backwards into a bulged fairi under the nose. The fin and rudder have be redesigned, a square-cut outline replacing t characteristic curved shape fitted to all p vious Yak fighters. With a M-004 unit n developing upwards of 3,000 pounds sta

Russian Jet Air Force

	Plane	Type	Powerplant	Speed	Remarks
Jets in Soviet Production	Yak-15	Fighter	Jumo 004	560-570 mph	
	Yak-15B	Fighter	M-004	600 mph	
	Yak-17	Fighter			Compares with F-84
	Yak-21	Interceptor	Walter 509C rocket units	670 mph plus	
	MiG-9	Close-Support	2 BMW 003's	515-520 mph	
	MiG-15	Interceptor	Copy of Nene	640 mph	
	La-15	Fighter-Bomber	2 M-003's	520 mph	
	La-17	Fighter	Nene derivative	600 mph	
	Tu-4	Heavy Bomber			Copy of AF B-29
	Tu-8	Attack Bomber	2 M-003 or 004		
	Tu-10	Fighter-Bomber	2 turbojets	520-540 mph	Comparable to RAF Canberra
	Il-16	Attack Bomber	4 turbojets		Comparable to AF B-45

RED AIR FORCE today is almost entirely jet. The aircraft listed here are the latest design that make up the Air Arm of the Soviet. The MiG-15 has been in battle action in Kore

rust, the Yak's maximum speed is proba-
y now close upon 600 mph.

An intermediate stage in Soviet jet fighter
sign-thinking is to be seen in Yakovlev's
'hunderjetovitch," believed designated
ak-17 and the precursor of the really
tra-modern series of jet fighters that are
scribed later in this article. Of typical
viet simplicity, the Yak-17 is of very clear
rodynamic form, prominent features being
e very tall fin and rudder and high-set tail-
ane. The empennage is rather more angular
an that of the Yak-15B, and the wing
s a straight-edged tapered planform with
uare-cut tips. A nosewheel undercarriage
fitted, and a large tail bumper safeguards
ainst tail-down landings. A swept wing
d tail variant of the Yak-17 is flying.

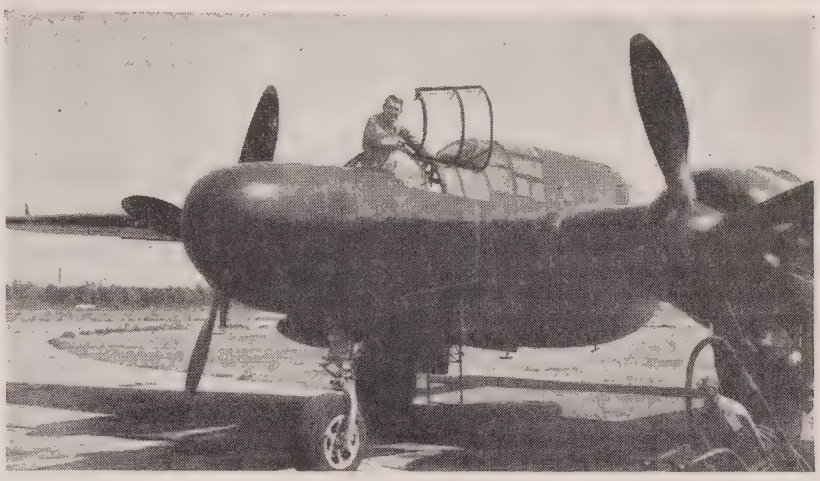
The Yak-17 appears to compare with the
84 in both operational role and general
rformance. Wing loading of the Soviet
rplane would be rather lower than that of
e U. S. machine, and maneuverability is,
erefore, probably better at altitude. Range
anticipated to be a little less than that
the USAF fighter.

It is an accepted military maxim that the
eapons developed in the closing stages of
ie war will be those first used in the open-
g stages of the second. A case in point
ay well prove to be the pure-rocket air-
aft. It is believed that, simultaneously with
e design of the more orthodox fighters,
lex Yakovlev was commissioned to investi-
te the specialized "target-defense" inter-
ptor as envisaged and used operationally
the *Luftwaffe* during the closing stages
the last war. The results of his work, fre-
ently reported of late from Iron Curtain
untries as the Yak-21, may be the Soviet
cket-propelled monoplane that a Russian
ience magazine claimed had flown at speeds
nsiderably greater than Mach unity. This
ane was described as "arrow-head shaped"
d designed by Yakovlev. The "target-de-
nse" interceptor is at present the only
own Soviet machine conforming to this
scription.

Based on Germany's startling Junkers Ju-
248 (or Me-8-263), an outgrowth of Alex
ppisch's Me-163, used by the Germans in
last ditch effort to stop our aerial death
ws, the rocket interceptor has a large-
a tailplane, unlike its German forbears
ich featured no horizontal tail surfaces.
e addition of the tailplane should have
tle adverse effect on the high speed and
e of climb obtained by the high thrust
the small rocket motor, or on the result-
g high power/weight ratio of the diminu-
e plane.

The Walter rocket units used in Germany's
get-defense machines and, in modified
m, in the Red model, were manufactured
Kiel up to 1944. It is ironic that Anglo-
erican bombing compelled the factories
move to Prague, now deep in the Soviet
here of influence." Reports indicate that
y comparatively small numbers of Yak-
s have so far been completed and, if in
at all, they are certain to be based
und Soviet industrial areas west of the
als within range of possible Anglo-Amer-
n bombing.

Lieutenant Colonel Tokaev stressed the
ncentration with which the Soviet is devel-
ng this type, although it is to be ex-
ted that the many teething troubles of
h a radical design have yet to be en-
ly overcome. Powered by a development



Museum Bound

WORLD WAR II Northrop *Black Widow* is shown here just prior to its take-off for Chicago. Destined for the USAF Technology Museum, the *Black Widow* joins other famed aircraft which made colorful flight history in the Pacific and European combat areas. The plane was flown to Chicago by Lt. Col. Leo C. Moon, AFAMC.

of the Walter HWK-509C liquid fuel rocket, developing some 4,500 pounds thrust, the Yakovlev rocket interceptor has increased range and improved handling compared with the original Me-163B. Maximum speed is probably well in excess of 670 mph and climb some 12,000 feet per minute. However, it is doubtful if endurance has yet been extended much above 15-20 minutes. Development of this type is probably being undertaken between Yakovlev's design team and the research establishment of Junkers, rumored to be operating at Kimtey, some 160 kilometres north of Moscow.

A. I. Mikoyan and M. I. Gurevitch have long worked as joint heads of a design team specializing in producing fighters. The well-known wartime piston-engined MiG-1 and MiG-3 fighters resulted from this collaboration.

It was to be expected that this successful design team would be among the first to produce jet fighters and it is obvious that Alex Yakovlev was not the only Soviet designer with his eye on a Stalin prize for a jet fighter, for Artem I. Mikoyan and Mikhail I. Gurevich soon came up with the MiG-9 which went into squadron service hot on the heels of the Yak-15 and has since proved comparatively successful.

In line with Yakovlev's earlier efforts, the MiG-9 conformed to the "pod-and-boom" formula which, until the appearance of Sweden's J-29 fighter, was almost a prerogative of Soviet designers. Somewhat slower and heavier than the Yak-15, the MiG-9 carried a formidable armament consisting of one 30-mm shell gun and two guns of 20-mm or 12.7-mm. German turbojets were installed (two BMW-003) slung under the belly of the fuselage. Whereas the Yak-15 retained a tailwheel undercarriage in its first production form, the MiG-9 featured one of Russia's first completely retractable nosewheel units, and the pilot, placed well over the nose, had an excellent field of view. Now in squadron service in appreciable numbers, the MiG-9's heavy armament and reputed excellent handling qualities at low altitude make the design pre-eminently suitable for ground attack and close-support operation, although the machine is obviously intended to undertake the additional role of low- and medium-level interceptor. Maximum speed is in the region of 515 to 520 mph at low altitude.

Some three years ago a new Mikoyan-Gurevich design made its appearance. This design, reported as the MiG-11, has not been heard of again since its initial appearance, giving the impression that the design was not entirely successful and was dropped in favor of a more advanced design. With a shoulder-mounted wing of small span and sharp taper, the MiG-11 appears appreciably smaller than the MiG-9 from which it is obviously derived, and its fuselage is considerably more rotund. The axial-flow turbojet is mounted further aft than those of the MiG-9 and its exhausts are below a boom-like rear fuselage. Apparently intended for interception, the MiG-11 should be faster than either the Yak-15 or MiG-9, although wing loading is appreciably greater than the earlier machines with a consequent reduction in powers of maneuver.

The first truly modern Soviet interceptor to enter squadron service has also emerged from the Mikoyan-Gurevich stable. Possibly designated MiG-15 (since Soviet fighters are invariably allotted odd type numbers, and the Russians usually skip the designation number 13), this new fighter has been frequently reported in groups of 15 and 20 machines at one time, and denote a radical step forward in Russian design technique—a type well able to oppose *any* U. S. or British jet.

High spot of this latest design is that it not only embodies the advanced ideas of German technicians now working for the Soviet but it is almost certainly powered by one of a new and powerful range of turbojets, including copies of the Rolls-Royce *Nene* which has been prepared for produc-

(*Continued on page 36*)

Russian Air Force

(*Continued from page 35*)

tion in Russia by Engineer Chelomey. This new fighter, as advanced in layout as the F-86, combines 40° wing sweepback with a sharply swept-back fin and high-positioned tailplane. The tail sweep angle is approximately the same as that of the mid-set wing and, due to generous wing area and light loadings, the MiG-15 can probably outmaneuver the F-86 *Sabre*. Although, in practice, it is doubtful if maximum level speed exceeds 640 mph. However, this new machine should be easily capable of reaching and fighting B-36 and B-50 formations.

The fuselage is of good aerodynamic form with an orthodox straight-through arrangement of the jet ducts. The pilot is seated well forward beneath a 360°-vision canopy, and the main armament is installed in the lower portion of the fuselage nose. This is thought to consist of one 30-mm cannon and one 20-mm, the barrels of which project slightly under the nose intake. The thin, high-pressure tire-fitted wheels of the undercarriage main members retract into wheel wells in the thin wing. The nosewheel folds backwards into the fuselage. A Russian-design ejector seat is installed.

While the trio, Mikoyan, Gurevich and Yakovlev, were busy with their medium and high-altitude interceptors, little was heard of Russia's other top-line fighter designer, Lieutenant General Semyon A. Lavochkin, well-known for his series of piston-engined fighters (the La-7, La-9 and La-11) which are still in quantity service with Russian fighter regiments and satellite air forces, and have made brief but unspectacular appearances over the Korean battlefront.

For some time a twin-jet fighter bearing a passing resemblance to the Messerschmitt Me-262 *Sturmvogel* has puzzled students of Russian military aviation. A contemporary of the MiG-9, it is now known that this machine was designed by Lavochkin and is believed designated La-15. Of rather more conventional appearance than the MiG and Yak efforts of that time, Lavochkin apparently found much inspiration in the Me-262 though his design is, in actual fact, entirely new. Powered by two M-003 turbojets mounted under the wing and each developing upwards of 2500 pounds thrust, the La-15 has a wing which, unlike that of the Me-262, features no sweepback. A heavy armament of 30-mm and 20-mm guns is carried in the fuselage nose and external racks are provided for 100-kg and 250-kg bombs or air-to-ground rockets. Presumably intended for the roles of fighter-reconnaissance, fighter-bomber and ground-attack, the LA-15's maximum speed is believed to be in the region of 520 mph at 20,000 feet. Few reports of the La-15 have filtered through the "Iron Curtain" but a two-seat radar-equipped night-fighter variant is believed to have been developed. Like the La-15, it is not known if the type is in service.

Semyon Lavochkin is also the author of the second of Russia's new generation of interceptor fighters, a machine comparable to the MiG-15 and now in full-scale production. Thought to be designated La-17, Lavochkin's latest bears more than a passing resemblance to the MiG design, the similarity in design thinking indicating a common source of research data.

Whereas the MiG-15 has a full mid-wing, the Lavochkin La-17 features a shoulder-mounted wing, also sweptback some 40°. The tail unit, likewise sweptback, is similar in configuration to the MiG design but has rather cleaner lines. The narrow-track tricycle undercarriage retracts into the fuselage belly, the nosewheel retracting backwards and the main wheels folding inwards and forwards. All wheel units are enclosed by flush-fitting doors. Armament, like that of the MiG-15, is installed in the lower part of the fuselage nose, but the barrels of the two cannon (one 30-mm and one 20-mm) do not project from the blast tubes as in th MiG. Both MiG-15 and La-17 are about th same size, span being estimated at 36 fe and length at 40 feet, and it is probable tha a similar turbojet is installed in both d signs. The single turbojet is fed through nose intake. If a derivative of a centrifug compressor *Nene* is installed, we can expe to see some form of flush-fitting side intake on future developments, even though th Russian's traditional love of simplicity ha biased them in favor of the simple, straigh forward nose intake seen on all Red je fighters to date. The only departure fro this type of aspiration system is to be see on the transonic research machine illu trated here.

As both the Lavochkin and Mikoyan Gurevich designs are in large-scale produc tion, it is reasonable to surmise that the pe formance of both machines compares fa vorably. It is probable that, like on Russia wartime fighters, internal equipment an armor have been kept down to a minimun thus reducing the La-17's wing loading t something below that of its Western co temporaries. This feature, combined wit moderate span and aspect ratio, should mak for high maneuverability and good handlin characteristics in high G turns and pull-out

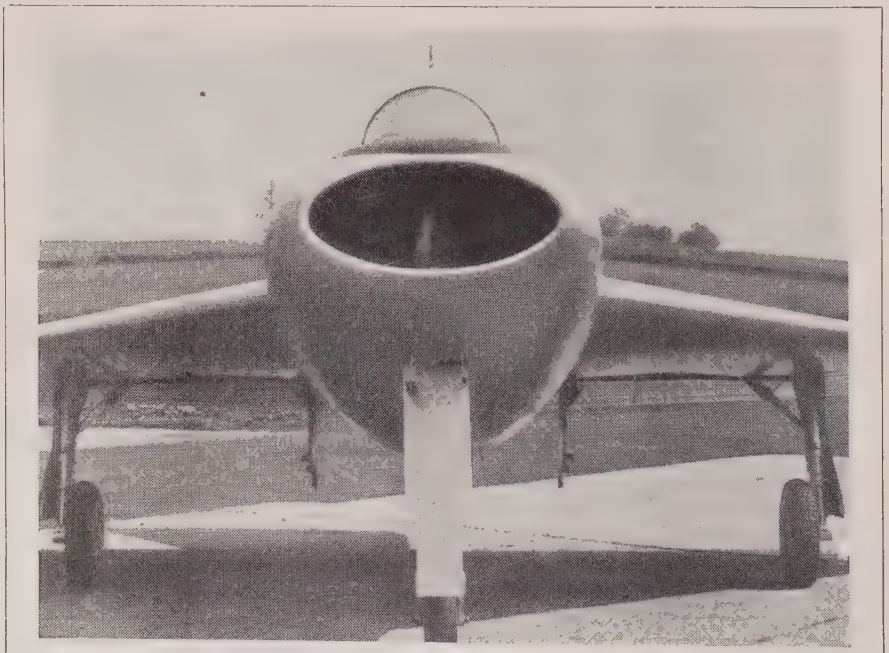
So far we have only dealt with the Sovie Union's fighter designers, but what of Ru sia's bomber designers. . . . Have they lagge behind jet fighter development?

Lieutenant General Andrei Nikolaevic Tupolev, the doyen of Soviet airplane d signers, has always specialized in the desig of bombing airplanes. This very versatile d signer has produced a number of heav bombers including his wartime TB-7 (whic was later redesigned by Vladmir Petlyak as the Pe-8), but his designs have alway lacked that something that makes a real first-class combat machine. That the *Poli buro* reached similar conclusions is evidence by the considerable periods that Tupol has spent in Russian prisons. Although th award of a prison sentence to a design whose airplane is unsuccessful may see amusing to Western eyes, it must be co ceded that the Soviets have a strictly pra tical outlook, permitting, and indeed encou aging, the disgraced designer to contin his work while in prison. It is not uncomm for a designer, so imprisoned, to produce his best while segregated from the norm every day stresses of Soviet life, emergi from prison with a prize-winning design. case in point is Tupolev who, while so co fined, produced Russia's best piston-engin attack bomber, the Tupolev Tu-2.

Being the most experienced of the f Soviet heavy-bomber designers, it was to expected that Tupolev would be given t complicated task of breaking-down and pr paring for Soviet production the Boei B-29. That he succeeded in his endeavo can be seen from the fact that increasing large quantities of Tupolev Tu-4's (as t "Superfortress-ovitch" is now known to designated) are coming into squadron se ice; a total of between four and five hu dred Tu-4 heavy bombers have already be delivered.

These are being used by the A.D.D. (Lon Range Aviation), the control of which cently passed from the Soviet Air Force the Soviet Navy. Thus, the Navy will n be responsible for all long-range strate

(*Continued on page 49*)



AIR INTAKE belongs to the Boulton Paul P. 111, Great Britain's latest delta-wing research plane which recently made its first flight. Engine is the *Nene*

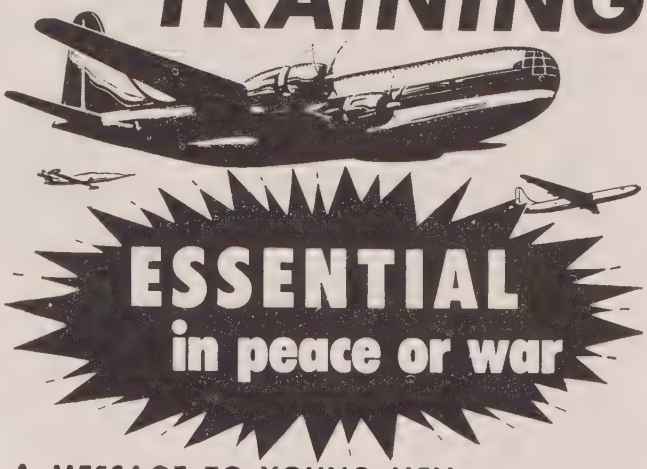
Selling to the Air Navy

(*Continued from page 17*)

apults, barriers, arresting gear.
Class 93: Special aeronautical training devices and parts.
Class 94: Aircraft armament, aviation ordnance, aviation fire ntrol equipment.
Class 96: Rockets, guided missiles.
What agencies do the actual buying? The Bureau of Aeronau-s, Navy Department, Washington 25, D. C. is the prime agency buying Air Navy's planes, powerplants and instruments. Naval craft ordnance is purchased by the Bureau of Ordnance uOrd), Navy Department, Washington 25, D. C. BuAer co-dinates on aircraft armament and other government furnished rts or property (GFP) with the Naval Aviation Supply Office, ford Avenue and Martins Mill Road, Philadelphia 11, Pa. is office (ASO) buys all spare parts and raw materials re-ired in the Air Navy's maintenance program and re-orders from nufacturers all spares required for specific aircraft models.
Information on local general procurement may be obtained by dressing the Commanding Officer, Naval Air Station, Patuxent ver, Md.; Jacksonville, Fla.; Miami, Fla.; Corpus Christi, Tex.; llas 2, Tex.; Memphis 15, Tenn. Also, Commander, Naval Air aterial Center, U. S. Naval Base, Philadelphia 12, Pa.; Supply ficer, Naval Air Station, Pensacola, Fla.; and Commander, arine Corps Air Station, El Toro, Santa Ana, Calif.
These are all known in Navy as "purchasing activities."
The Navy does most of its purchasing on a basis of formal mpetitive bidding. Award is made with reasonable promptness written notice to that responsible bidder whose bid, conforming the invitation for bids, will be most advantageous to the Gov-nment, price and other factors considered.
The Navy reserves the right, however, to reject all bids or to cept modified bids *if* the modification can be made without ejudice to competitors. In some cases formal competitive bid-ng is not advantageous to the Government, particularly when ere is no competition among bidders. In those cases negotiation a method of arriving at a fair and equitable price for both par-s of the transaction is used.
The Department of the Navy welcomes a large number of bid-rs when it is buying any item. If a manufacturer, large or all, is interested in becoming a Navy supplier, he should write each of the agencies or "purchasing activities" mentioned ve, and request that he be placed on the mailing list. The spective supplier's qualifications and potential productive abili-s will normally be checked by an inspector of naval material. his operation is found satisfactory, he may receive an invitation bid when next the items he manufactures are bought.
Two booklets prepared by the Navy Department will be of great istance. The first is a 40-page blue booklet called "*Selling to the vy*," published particularly for the assistance of the smaller busi-ss concerns of the United States; its number is NAVEXOS P-548. The other is a larger, fully indexed pamphlet entitled "*Purchased rts and Purchasing Locations of the Department of the Navy*," (AVEXOS P-616), put out by the Office of Naval Materials. Both oklets are for sale by the Superintendent of Documents, U. S. vernment Printing Office, Washington 25, D. C. at 15 cents each.
A more interesting way to get hold of these useful booklets uld be to visit, phone or write to that answer-to-the-small-busi-ssman's-prayer: the Central Military Procurement Information ce, Room 3D-760, The Pentagon, Washington 25, D. C. In this m either a WAVE lieutenant, a WAC captain or a WAF major l have the answers—or can tell you in short order where the wers can be gotten. Lt. Joan Flickinger holds up the Navy cor-of the triangle. All three gals will tell you, however, that a t to Washington is not necessary in order to do business with government. In fact, most military purchasing is done else-re. A letter to the CMPIO will bring you the aforementioned klets and you can take it from there.
Here are a few more tips. The (Naval) Aviation Supply Office ntains an ASO Bidders List. Write to the Purchasing Officer, D, Philadelphia 11, Penna., and state the nature of the items are interested in supplying. The ASO will send you the nec-ry forms by mail.
You get an "invitation to bid" on an item, either send in a or explain by brief letter or postcard why you are not bidding that particular item. If you fail to make some reply to the itation for bid," you will be dropped from the active list.

(*Continued on page 52*)

AVIATION TRAINING



ESSENTIAL in peace or war

A MESSAGE TO YOUNG MEN... AND PARENTS

We have an urgent demand for Embry-Riddle graduates. Aircraft manufacturers and operators need thousands of *properly trained* young men for *essential* positions in civilian aviation.

SAVE TIME

Now, more than ever before, you need maximum school training in minimum time. Embry-Riddle offers complete eight-month to two-year aeronautical engineering, master A & E mechanic, flying and specialist courses, backed by a quarter-century experience in training today's aviation leaders.

BE PREPARED

No one can safely predict the course of events today. Be assured, however, that no matter what happens, you will be one step ahead of the crowd with up-to-date, intensive Embry-Riddle aviation training. Write, wire or call *today* for catalog and full information.

Embry Riddle International
SCHOOL OF AVIATION
RIDDLE-McKAY COLLEGE OF AERONAUTICS
MIAMI 30, FLORIDA

Wherever planes fly, men know Embry-Riddle . . .
A Famous Name in Aviation.

Dean of Enrollments - Dept. 93
Embry-Riddle School of Aviation
Miami 30, Florida

Please Print

NAME _____

ADDRESS _____

City _____

State _____ Age ____

I am interested in . . .

- ☐ A.&E. Mechanic
- ☐ Commercial Pilot
- ☐ Engineering
- ☐ A.&E. Combined with Commercial Pilot
- ☐ Flying Mechanic
- ☐ Drafting & Design

Check One ☐ Veteran ☐ Non-Veteran

TRAIN IN MIAMI -- AIR CAPITAL OF THE WORLD

Markers are Insurance

(*Continued from page 23*)

are spread unevenly throughout the United States. While many of them do not conform to the design of a standard marker as approved by the CAA and the International Civil Aviation Organization, they are shown on aeronautical charts, as are standard markers.

Markers have been placed on factories, schools, highways, forest fire lookout towers, water towers, on the ground—and one is on a church. While painted markers are the most common, many other materials have been used—porcelain enamel, rocks, and shrubs.

A standard marker contains, in chrome yellow letters and figures on a black background, (1) the name of the town, (2) the latitude and longitude, in degrees and minuts, (3) a large arrow pointing true north, (4) the airport symbol—a circle and small arrow pointing to the nearest airport and showing the mileage to the airport. The letters should be at least 10 feet high and the numbers 7 feet. It should be readable from 3,000 feet. The average cost of a painted marker is $75.00.

Some advertising may be included, but it is limited to an area equal to 20 per cent of the painted marker area, and should be of a different color.

Some towns go in for giant markers, and there have been many claims to the "largest marker in the world." Coeur d'Alene, Idaho, has a marker with 50-foot letters. Sunny South Airport, Miami, also has 50-foot letters in its marker of coral rock. Daytona Beach claims a marker with 70-foot letters that is 1,140 feet long. At Pomona, California, the Jr. Chamber of Commerce together with the American Legion and Boy Scouts have installed a marker they claim has letters of 97 feet by 15 feet. The pilots are delighted to see these markers but, if they had their choice, would trade one big marker for several average-sized ones.

When in 1945 it was decided that private pilots should have cross-country routes, somewhat like motor highways, a system of 34 skyways, totaling about 53,000 miles, was laid out by the Air Marking Branch of CAA. A skyway is a 40-mile-wide flying route between selected terminal points, and over the best flying terrain. It should be indicated by an air marker at least every 125 miles. Twelve of these skyways have been "dedicated" by the CAA, the other 22 are "proposed." To date the job is far from complete on any of the 34 skyways since many of the markers have not been put in—lack of money being the reason.

Yet these markers and skyways are badly needed to keep the private and non-scheduled pilot from being lost—poor navigation is responsible for an estimated 12 per cent of accidents to private flyers. Officials have said that bad navigation is one of the three main causes of aviation accidents. Since 483,544 of the 491,306 pilots in the United States are private and non-scheduled, the absence of markers is a contributing factor in the accident rate.

Of the 92,537 civil aircraft in the United States, 1,164 are airline and 91,373 are private and non-scheduled craft. Of the total aircraft, about 52,737 have no radio, either receiver-transmitter or transmitter.

These private and non-scheduled flyers spend a lot of time in the air. The last complete figures, for 1948, show they flew 15,130,000 hours—more than 7 times the 1,944,156 revenue hours flown by domestic scheduled airlines.

We now have more than three times as many private planes as before the war. Yet we have less than one-fourth the number of markers that we had then.

For the private flyer, radio is not the complete answer as many pilots do not have the time to learn the intricacies of radio flying. Also, radios sometimes go out or static prevents reception.

Although the Air Marking Branch of CAA has no money for installing markers, it does have a small fund for experiments using new materials and methods, and some of its most useful work is along this line. One experimental marker was installed at Bethesda, Maryland, using a rubber-base paint. Another, put on a Maryland University building at College Park, used porcelain enamel.

The latest experimental marker was installed this summer at Fairfax, Virginia, on the high school building. The marker contains only the town name "Fairfax" and the airport symbol, which points to the Washington National Airport, 15 miles distant. It was planned and laid out by the Air Marking Branch. Different materials were used for the letters in "Fairfax" and for the airport symbol. This was done for purposes of comparing the durability of the materials under exactly the same conditions.

The name "Fairfax" is in 10-foot letters. They were first painted with a ready mixed aluminum paint, which was permitted to dry. This base coat was to prevent bleeding through of the asphalt composition roof. Then Prismo yellow-binder paint was sprayed on, after which the wet, painted area was sprinkled with newly patented glass beads. They are about the size of sand grains and clear in color. These beads were sprinkled on by hand, since it was found that a more uniform distribution resulted than when an applicator was used.

The airport symbol—small circle, arrow, and 15 miles—was painted with rubber-base paint, Federal Specification TT-P-91. No undercoating was used, as previous experiments showed that with a rubber-base paint there is no bleeding through of the asphalt on the roof. This portion of the marker not treated with the glass beads.

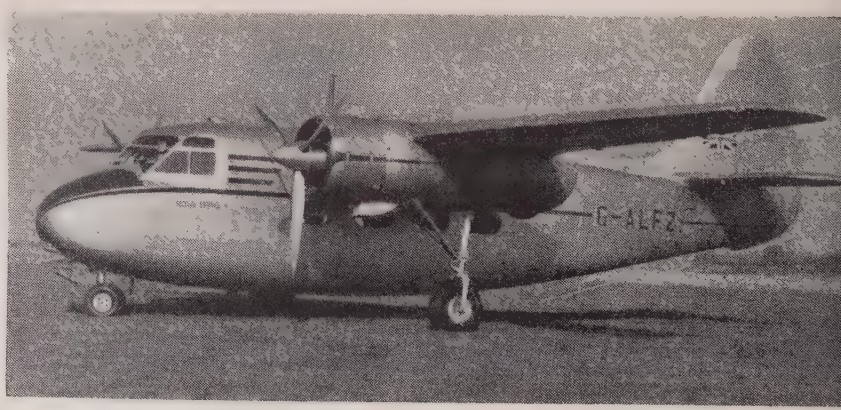
The accompanying photographs, m during the installation, show the steps ta in preparing the Fairfax marker. These s could be followed by any one installin similar sign. One gallon of aluminum pa costing $4.35, was used. One air-marking including 1 gallon of yellow-binder p with thinner and glass beads, cost $35 The bead dispenser, first used but found effective than hand-sprinkling, cost $3 A gallon of rubber-base paint was dona Two painters, the use of their truck an portable compressor with a spray gun, $75.00. Also, two men from the Air Mark Branch—J. D. Gemmell and George De —worked on the installation. It took four men four hours to install the mar The area treated was 313 square feet. sides the time spent by the CAA men, total cost was $118.10. It has been fo that experimental markers generally from 15 to 20 per cent more than su quent markers using the same materials.

This marker will be inspected from t to time. The materials will be compared w each other as to durability, price and bility. Comparisons will also be made w other experimental markers.

Blanche Noyes, Chief of Air Marking CAA, supervises the plans and installati of experimental markers and often d part of the actual work. A pilot herself, has probably flown more than any woma the United States, having almost 11, hours in her log book.

The widow of an air mail pilot killed a crash, Mrs. Noyes has headed the marking program since 1936. She s "Great credit is due the clubs, organizati and individuals who have installed mark State Directors of Aeronautics Commissi are responsible for most of the markers so are due special credit. Everybody w to be on a skyway and everybody w markers. They have saved thousands of l and literally hundreds of thousands of lars. When you consider that the aver cost of a painted marker is only $75.0 think that every town should be mark

Every town should be marked—and yours isn't, why not get a civic group do the job.



PERCIVAL PRINCE is a twin-engine feeder-line plane developed from the 1947 *Merganser*. The *Prince* seats from eight to 12 passengers or can be used to haul cargo exclusively. It is powered by two 500-hp Alvis engines, cruises at 168 mph

Tokyo Airlift

(*Continued from page 26*)

inboard and outboard props will rotate ly. By moving one prop control slowly, can stop that shadow and those two en- es are "in synch." Then you match the t and left pairs of engines by ear. At nt? Turn on a landing light and the low is still there.

he one sure check-point on this longest- he-world overwater flight is the U.S. Coast Geodetic ship stationed at the mid-point the hop. It has another name, but the ts all call it "bird-dog" because they can ie in with their radio compass and then rd-dog" toward the radio beacon on the .

here was a broken undercast at 4,000 feet ve flew west into the sunset, and it seemed hours before the sun finally went down. the sun gradually slid into the ocean, the ouette of the clouds ahead looked exactly the rugged spires of Monument Valley in northeast corner of Arizona. However, the s were all below us and we didn't log a le minute of instruments on the whole ½-hour flight.

he ever-present card game among our pas- gers continued well into the evening. ry long over-water flight with military sonnel seems to result in a game on the r in the back of the cabin . . . and some hose games are expensive.

purser is carried on all passenger flights, on this hop we had Robert Hodges of lewood. Pursers are the only members of ular flight crews who are permitted to fly nuch as they want to. Hodges was on his d trans-Pacific flight that month. From crew's standpoint one of the advantages aving a purser aboard is that he keeps supplied with hot soup, coffee or milk. r about six hours in the air, the query, es anyone want some hot soup?" really the spot. The soup is heated in a little tric one-can-at-a-time hot chocolate cup. n the Tiger's bulletin board at Burbank a letter from the CAA recounting a re- flight back from Honolulu in which five sengers picked up a violent, though not gerous, case of ptomaine poisoning from in-flight box lunches that go with each enger flight. The CAA whimsically ad- d all over-water flight crews to issue box hes to their passengers at least an hour a half before they ate them themselves. wo hours out from Honolulu the two radio passes began to settle down on zero and navigator's job was about over. When we d see the bright lights on the eastern e, we cancelled our instrument flight plan came in over the top of the island.

rom the air at night, Honolulu was a e of street lights. We let down slowly so our passengers would not have any ear ble. Commercial airliners are restricted 300-fpm rate of descent.

st prior to landing, the purser sprayed airplane thoroughly to comply with the Department of Agriculture regulations. the passengers and crew sprayed the e with sneezes.

hile Ed Pinke circled down over the air- I read through the pre-landing check Fuel boost pumps go on all four engines, autopilot comes off, hydraulic pressure is ked, the speed slows to 144 mph and the goes down. A red (unsafe) light shines briefly as the gear is in motion and then three green lights come on in the center of the instrument panel, one for each main gear and one for the nose wheel.

The co-pilot does very little during the actual landing except to drop the degree of flaps required by the pilot. Then you open the cowl flaps, shut off the boost pumps, open the hydraulic by-pass to the landing gear so that it is impossible to retract it by accident, pull up the flaps and, in tropical country open your window to cut down the cabin heat.

We taxied up to the Honolulu ramp and parked behind a Pan American *Stratocruiser* just about to depart for the mainland. Most of the passengers wore flowered lei's and their friends waved gaily as the engines were started. A large neon sign spelled out "Aloha," but there was no band in sight. By contrast, our passengers were just a bit tired and not looking forward to any particular vacation. There were no flowered lei's and no waving hands.

It was 1:30 A.M. when we turned the airplane over to the Tiger crew waiting to take it on—in true stagecoach fashion—to Wake Island. Then the four of us took a cab for the Moana Hotel. Our purser went on with the airplane.

Next morning we had breakfast under the famed Banyan tree at the Moana Hotel and talked long-range flying with other flight crews. The hotel gives a special rate to trans-Pacific flight crews and nearly everyone on the Airlift was staying there. In the past month, over 1,000 Pan American crews alone had put in their "crew rest" at the Moana.

The next DC-4 in the Flying Tiger shuttle arrived early in the afternoon and we were at the airport to meet it. Passengers again. That meant that Ed Pinke had to buy box lunches for the 30-odd people in the cabin. Each Captain on the Airlift, for the Tigers at least, starts out from Burbank with $500 of company money. That's to cover lunches, landing fees, hotels and cabs and serve as a bank for the flight crews if they run short of money.

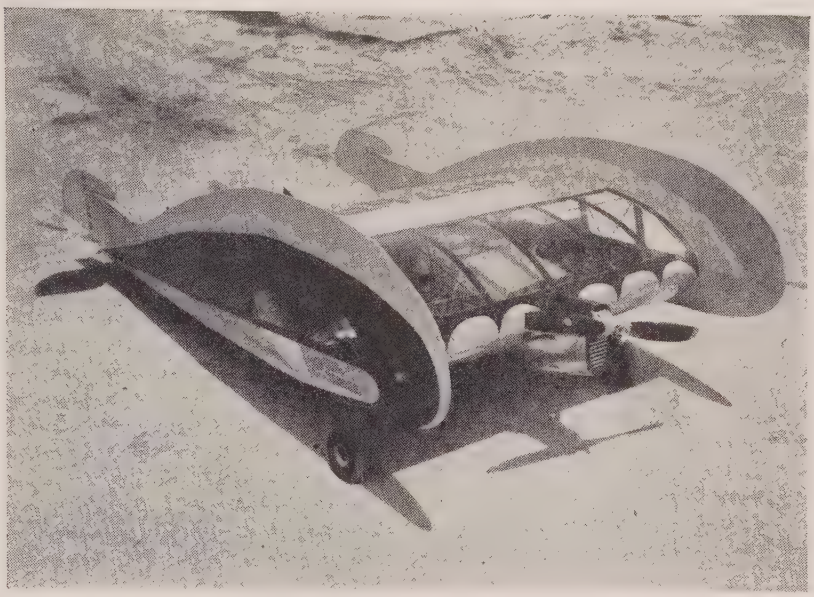
Before we took off from Honolulu, some of the other pilots were joking about a ship that had come into Honolulu shepherded by an Air-Sea Rescue Unit. It seemed that this airplane had split a cylinder head just west of "bird dog." On a four-engined airplane, having one malfunction doesn't make too much difference. However, in this case another engine had started using excessive oil. Each engine has a 20-gallon oil tank, but this particular ship used all the 20 gallons plus the full 50-gallon reserve in the cabin tank. Since the load aboard had been passengers, the Captain wisely put in a call for the convoy by an Air Force SB-17 with a droppable boat.

It was the first flight for many of the passengers and some of them began to worry when they saw that feathered engine and the SB-17 escort. When the purser was unable to quiet their fears, the navigator went back into the cabin and did a little fibbing.

"You see, we get paid by the hour in the air," explained the man with the sextant. "We've just shut one down so that it'll take a little longer!" And the non-flying passengers quit worrying.

It was the first time that the Air-Sea Rescue had been out on an actual call in weeks. Navigators are so sharp on these crews that if they ever miss an "intercept," they're grounded. The rescue ships fly out to the area where the crippled plane is reported and

(*Continued on page 42*)



Wingless Plane

Here's another "answer" to the flying automobile problem. William E. Horton of Caseville, Michigan, an aeronautical and automobile design engineer, is the inventor of this strange looking wingless airplane. It is now undergoing flight and ground tests at Gilbert Field, Winter Haven, Florida. According to the inventor, this plane will cruise at 200 mph in the air and will travel on the ground at a rate of speed comparable to today's autos.

Exercise Rainbow

(*Continued from page 21*)

Kaiserlautern; RAF Squadron 16, using British *Vampire* jet fighters, operating from Rhein-Main Air Base; and the 2/33 Observation-Reconnaissance Squadron of the French Air Force, using F-51 *Mustangs*, operating from the Wiesbaden Air Base. The air arm of the U.S. Forces directed its all-out effort to the struggle to gain air superiority in the local area. In addition attacks were made against bridges and transportation lines to the rear of the withdrawing U.S. Forces.

The 60th Troop Carrier Group, although utilized mainly by U.S. Forces, made a simulated "dummy" paratroop drop for the Aggressor Forces behind the U.S. defense lines early in the maneuver. This paradrop, involving an enemy battalion, was considered 100 per cent effective.

For the final phase of the exercise two F-80 squadrons were transferred from the Aggressor to the U.S. Forces and moved by air from Furstenfeldbruck to the Rhein-Main and Wiesbaden Air Bases. This gave the U.S. Forces air superiority for the counter-offensive to the east during the final phase of the maneuver.

As air superiority shifted to the side of the U.S. Forces, likewise, the mission of the U.S. Air Forces shifted from one of struggling against the enemy in the air to one of interdiction and direct support of our advancing ground forces. Every available fighter-bomber aircraft, loaded with machine guns, rockets and bombs, was brought into action against the enemy.

One long-range strategic bombing attack was staged by the Aggressor with a flight of three B-50 medium bombers, escorted by eight F-84 *Thunderjet* escort fighters, flying from bases in the United Kingdom. The U.S. early warning system was quick to detect the approaching bombers, and after interception, two of the bombers were judged by umpires to have been destroyed, and the third driven away before reaching its assigned target.

An actual supply drop was accomplished when a flight of C-82's parachuted over 15,000 pounds of rations to the U.S. troops in forward positions during their counter-attack to the east.

A new and greatly improved system of umpiring was used during the maneuver to determine the effectiveness and losses of each air strike. One air umpire accompanied each aerial flight, and a ground umpire was assigned to each ground unit. Through air-ground radio communications, the umpires were able to quickly and efficiently evaluate each strike to determine its degree of effectiveness.

As an example of the closely coordinated Army-Navy-Air Force activities of Exercise Rainbow, one might point out the various systems of aircraft control during their strikes on surface targets. It was not at all unusual to find an air-control officer directing fighter-bomber aircraft to their targets by radio from the deck of a naval boat floating on the Main River, from a tank in an advanced ground position, or from an Army liaison plane on a routine spotting flight.

U.S. Air Force planes flew some 450 missions comprising nearly 2,000 sorties during the week-long maneuver. As a training maneuver Exercise Rainbow was excellent—simulating an aggressor attack as closely as possible, short of an actual war. The U.S. Army, Navy, and Air Forces in Europe were termed "superior" by top ranking military observers of the Western Union, the North Atlantic Pact Nations, Spain, and the U.S.

Exercise Rainbow could in no way prove the adequacy of tactical units of the U.S. Air Forces in Europe in the event of an actual attack by an aggressor nation as was simulated during the maneuver. At present it is apparent that an attacking force would enjoy numerical air superiority over U.S., British, and French occupation forces in Germany at the outset of a conflict. General Mark W. Clark, Chief of Army Field Forces, stated during the maneuvers that increases in U.S. forces in Europe are forthcoming.

Exercise Rainbow, however, did prove conclusively that the U.S. Air Forces in Europe have a highly-skilled, well-trained, mobile striking force, capable and willing to operate in close coordination with, and support of, the unified defense team in the European Command.

Piper Pacers for '51

Feature of the new 1951 Piper *Pacer*, recently unveiled, is a non-inflammable plastic covering which is said to greatly prolong the life of the airplane's finish. Called Duraclad, this finish is applied over the welded steel fuselage and aluminum wing structure to provide a finish of extreme resiliency and toughness. It has a high gloss and is resistant to fading or bleaching in the sun. Two models of the *Pacer* are offered: the "125" powered by 125-hp Lycoming engine, and the "115" powered by the smaller 115-hp Lycoming. Cruising speed of the "125" is 125 mph at 7.7 gallons per hour. There is also a "135" which is a "125" with a controllable pitch propeller. The "135" cruises at more than 135 mph.

Radio Navigation

(*Continued from page 19*)

trite. But it is amazing how many cases of apparent radio "failure" are due to carelessness on the part of the pilot. I have in mind the experience of an acquaintance who nearly broke his neck that way.

On leave from an army base, this fellow flew home to see his relatives. The folks back home treated him royally. Naturally, he was reluctant to return to his station and so he prolonged his visit as long as possible.

On the way back to duty, he began to have some difficulty with his transmitter. When he landed for his first refueling, he tried to work out the bugs with a maintenance man instead of reporting the trouble on his flight form. Bad weather was looming ahead. And he was afraid that he would be grounded if his radio trouble became known.

As it happened, he flew into soup with his transmitter out of commission. It was nobody's fault but his own. By the skin of his teeth, he got through. If anything had hap-

pened, the radio surely would have received the blame. So, elementary as it may seem, I maintain that the radio, along with the rest of the equipment, should be checked regularly. Your radio won't let you down in a crucial moment if this is done.

A third consideration relative to radio navigation is to stay on the ball in regard to position. So many pilots who navigate by radio seem to think that, because the old needle points right home, it isn't necessary to study check points and determine groundspeed. Such reasoning is responsible for any unpopularity radio navigation may have attained among private pilots. The point is this: where with pilotage the flyer has to keep looking for visual check points, with radio, this is taken care of automatically. Beam intersections, fan markers, etc., provide the best check points there are. And by using these radio reference points to check against the clock, an accurate groundspeed may be determined. It's as simple as that. A radio direction finder chart, plus accurate tuning, attention to the clock and a healthy regard for the weather can enable anyone to get from "here to there" with safety and confidence. Here's how I did it.

After studying an aeronautical planning chart, I decided to fly by way of Winslow, Albuquerque, Tucumcari, Enid, St. Louis, Indianapolis, Pittsburgh and to New York. Then, on the regular Sectionals, I drew my course lines and corrected headings. Along the route, I marked 10-minute intervals, based upon my predicted airspeed.

Using RDF and radio facility charts, I plotted all omnirange stations and fixes along the way. On a separate log sheet, I listed the frequency of each radio aid. In flight, then, all that was necessary for me to do was consult my log sheet and tune from one station or fix to another as I flew along. Let me illustrate with a typical procedure.

Between St. Louis and Indianapolis are several excellent radio reference points. By tuning my omnirange receiver consecutively to Loogootie, Terra Haute and Indianapolis, I could read directly the heading to fly. Then, to determine my ground speed, I tuned the radio compass to Springfield and Effingham. When the radio compass needle pointed to 90° from course, or any other predetermined angle, I noted the clock time and got an accurate groundspeed.

Radio navigation, too, enabled me to compute drift. Many pilots prefer to follow the radio compass needle to the station without correcting for drift. When the crosswind is not excessive, I have found this to be satisfactory. But if you want to maintain a definite track, a few minutes' flight on one heading will show drift by a deflection of the needle. Correcting for the amount of deflection shown provides the right crab angle.

In addition to exploring the possibilities of radio navigation, I found several advantages to this system: radio navigation requires attention but not the constant strain of pilotage or dead reckoning techniques. By feeding figures into the radio equipment and reading the indicated results, the pilot finds that much of his work is done for him. If you are properly grounded in basic navigation procedures, a lesson or two on radio technique should qualify you to make a long and pleasant cross-country trip. Just remember to maintain a healthy respect for the weather and the clock.

TWA
Your biggest air travel bargain now better than ever!
TWA's NEW CONSTELLATION SKY COACH
NEW YORK—LOS ANGELES $110
NEW YORK—CHICAGO $35
CHICAGO—LOS ANGELES $85
Federal Tax Extra
See your travel agent or call Trans World Airlines
Across the U.S. and overseas... you can depend on TWA

AERONAUTICAL UNIVERSITY

FOUNDED BY CURTISS-WRIGHT

The number of persons employed in the aircraft industry, according to many experts, will double within 18 months. Aviation will be one of the big industries of the country. This step-up program has increased the already-urgent demand for highly trained specialists.

In the past 21 years more than 7500 men have graduated from the courses offered at A. U. They are steadily employed throughout the industry and have done their part in bringing aviation up to its present high level of development.

Prepare now for a most rewarding future at one of America's oldest recognized aeronautical schools. Graduates of Aeronautical Engineering fulfill the educational requirements for Air Force Cadet officer training for flight or engineering.

All classes at A. U. are scheduled to enable you to earn while you learn through part-time employment. Upon graduation you will receive assistance and guidance in obtaining a responsible position.

"IN PEACE OR WAR YOU ARE ESSENTIAL IN AVIATION"

MAIL COUPON NOW FOR FREE INFORMATION

AERONAUTICAL UNIVERSITY
Dept. 1071, 1905 Prairie Avenue, Chicago 16, Illinois

Please send me your free catalog, *Opportunities in Aviation*, and information about the following courses:

☐ AERONAUTICAL ENGINEERING (Degree Course)
☐ AIRPLANE AND ENGINE MECHANICS (C. A. A. Approved)
☐ AERO. ENG. DRAFTING
☐ PRE-ENGINEERING

Name.....

Address.....

Approved for veteran and civilian training. 22nd year. Outstanding faculty, modern equipment. State and U. S. Government approved. Big demand for graduates.

Tokyo Airlift

(*Continued from page 39*)

then start a zig-zag "ladder" search until the quarry is spotted.

The area covered by the Air-Sea Rescue at Hickam Field covers a radius of 1,000 miles from both Hawaii and Johnson Island, a good part of the distance to Wake Island, so we were assured of that "just-in-case" protection for the greater part of our next hop.

"There's no alternate for Wake Island," said our Navigator as we taxied out for takeoff. "If we don't get into Wake, we'll try paddling in a life raft," he added with a quick grin.

Even with nearly full tanks, the Tiger DC-4 pulled off the Honolulu runway with plenty of room to spare and we banked sharply out over the water to keep from flying over the downtown area. Our outbound trip was aided by a 20-knot tailwind until we passed a mild, but very wet, storm front about three hours out of Wake. Flight time to this 2¼-mile atoll was 11 hours and 15 minutes.

What we could see of Wake Island on a moonlit night was anything but impressive. It's small—the highest point (except for the control tower) is only 20 feet above high tide—but those blinking lights and that king-sized "homer" look like payday on Saturday night after the long, lonesome hop over nothing but dark water.

The 7,000-foot runway is well lighted and radio contact is excellent. The radio control tower here was staffed and equipped by the CAA in two weeks time to handle the rush of traffic for the Pacific Airlift. The airport is managed jointly by Pan American Airways and Transocean Airlines, and a token landing fee is charged—$11.36 for our DC-4, while a heavier Boeing *Stratocruiser* would be billed at $22.72.

On our full hop westbound from Honolulu, we hadn't seen another airplane. Yet we had to circle the island once to let a Sabena (Belgian) DC-4 land from Tokyo. Later on the ground the Sabena flight crew mentioned that they had spent over 230 hours in the air in the past month. However, this airline is using multiple crews so that only one set of pilots is at the controls for not over 120 hours. CAA regulations limit U.S. transport pilots to 100 hours per month and this restriction makes it difficult for dispatchers to maintain a smooth schedule. Pan American, for instance, has its crews scheduled to fly from San Francisco to Honolulu, Wake, Tokyo, back to Honolulu and then make another trip to Tokyo before returning to the Mainland. That totals roughly 100 hours in the air. The Flying Tiger Line has its crews make one full round-trip to Tokyo—about 74 hours—and then put in the remainder of their time on the company's regularly scheduled C-46 freight flights between Burbank, Denver, Chicago and Newark.

Wake Island is a story in itself. When we taxied up to the gas pumps in the middle of the night, six DC-4's were waiting to be fueled. Later that night in the Transocean crew quarters, a steady stream of landing airplane shattered the still Pacific night.

There are no tropical palms on the island, but it does have rats, mosquitoes and ants. A Tiger pilot on a flight ahead of us had accidentally left a candy bar in a shirt that he hung up for the night. When he awoke the next morning, the candy bar was gone—shirt pocket and all.

Typical of this topsy-turvy world was the remark made by the Transocean flight dispatcher when we dragged in from the airplane. "Did you guys bring any late newspapers? What's going on in the world—and on Korea?

There's one small advantage that Wake Island has over the famed beach at Waikiki. At Wake, you don't have to know whether you're a "Kane" or a "Wahine" when you're hunting for the washroom!

After just enough time on the ground to make us "legal," the Transocean dispatch board showed that Captain Pinke and crew were due to take N 90911 from "AWK" to "TKO". The cabin load was listed as "Explosives."

"That's OK," said Ed Pinke as we filled out the paper work. "If we get in a jam, we can always chuck the cargo over the side—and you can't do that with passengers. Besides, cargo doesn't walk up and down the cabin the way passengers do, and there's no reason to re-trim the airplane every couple of minutes."

Finally, one of the procession of lights that streaked onto the runway was our Flying Tiger airplane.

"How's she running?" Ed Pinke asked Captain Gene Muzinich of Van Nuys, California.

"Fine. Nothing wrong at all but a minor rocker-box leak on number four. Don't worry about it because we burned only 4 gallons of oil all the way in from Honolulu," said Muzinich. "It's a good airplane."

That's the way this crew "staging" works. You meet the pilot of the airplane you're scheduled to fly next, and he tells you if there are any malfunctions. Of course, any "squawks" are also written in the "Form #1" that stays with the airplane.

We went out to the airplane and I climbed up on the wings to check the gas tanks to make sure that they were full and that the big caps were fastened down tightly. Climbing around atop those oily wings at night is the most dangerous part of the trip for my money. The caps seemed secure. There were no suspicious damp spots on the underside of the wings that might denote a fuel leak and the engines didn't seem to leak any oil, so we climbed aboard.

The cargo was classified only as "Explosives." That's enough. It didn't take too much space in the cabin, but the weight and balance chart showed 5½ tons of payload.

I was the last member of our quartet to climb through the cabin door into the flight deck. There was Captain Pinke hooking his safety belt—in the right-hand seat.

"You've been going along for the ride long enough," he grinned. "You've had 25 hours in this airplane to learn where everything is located. Now I'm going to take it easy. It's your turn to fly!"

I climbed into the left seat and hooked my belt. It felt a little like an electric chair.

"You realize what we've got back there in the cabin?" I asked.

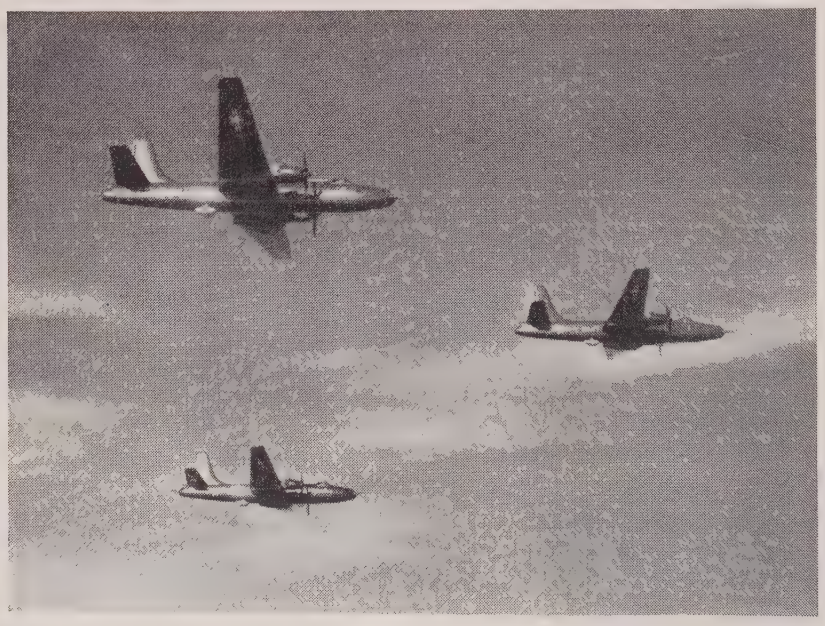
"Yup," replied Pinke.

The Tiger Captain read off the long check list and we started the engines. Normally Number 3 (inboard on the right side) is started first. The pilot works the boost pumps and the mixture controls on Numbers 3 and 4 while the co-pilot operates the starter energize, engage and prime. When the left pair of engines start, the procedure is reversed.

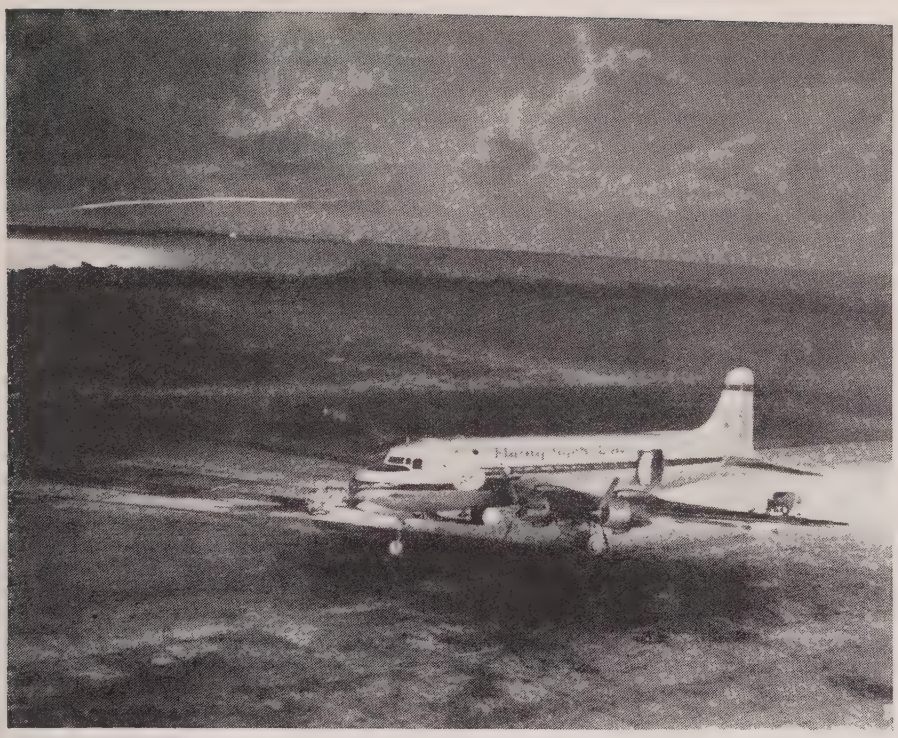
When all four fans were turning properly, the chocks came away from the wheels and Ed Pinke said, "Set your throttles at 1,000 rpm and do your steering with the nose wheel. Use both brakes together and make your turns very slowly or we'll slosh a lot of gas out the fuel overflow vents."

We taxied out slowly.

"Imagine that your right foot is on the



NAVY PILOTS are shown here demonstrating their skill in flying formation with Martin P4M-1 *Mercators*, long-range patrol planes. These big four-engine (two piston and two jet) anti-submarine and photo recon aircraft are in service with VP-21, a Fleet squadron based at the Naval Air Test Center at Patuxent River, Maryland



WAKE ISLAND under a full moon looks like this. Note path of plane with landing lights on at far left of photo. Flying Tiger Line plane in foreground is being re-fueled on field ramp

center line and just steer it," said Pinke.

The wheel works rather stiffly and it takes a split-second for the big 35-ton brute to react to the wheel. However, after a while you begin to get the feel of the ship on the ground.

There's only room for a single landing strip at Wake, so we had to wait until one DC-4 took off before we could taxi down the long, narrow runway. Another ship was waiting in the warm-up circle, so we rolled at a good clip for the mile and three-eighths.

"Go easy on the brakes," said Pinke as we approached the warm-up circle." These ships are plenty heavy."

The DC-4 slowed down with a mild application of both brakes and I cleared the runway into the warm-up circle so that the Philippine Airlines ship ahead of us could take-off.

After the landing lights were cut, we turned up the cockpit lights and went through the rest of the pre-take-off check list. All four propellers were "exercised." Each engine was checked out at 2,000 rpm, the flaps went down 15°, the boost pumps came down, the gear hydraulic bypass was closed and a dozen other essential items were checked.

Finally the Philippine ship took off into the dim moonlight and we pulled into take-off position. It was hot and sweaty in the cockpit even before the windows were closed and locked. Both Blair Johnson and Don Tyson were looking earnestly into the cockpit from their seats on the flight deck.

"Tiger's nine-one-one, you're cleared for take-off," said the Wake tower.

"Let's have 48 inches of manifold pressure," said Ed Pinke as I started forward on the four big throttles. "Steer the ship with the nose wheel until you hit 70 mph, then reach over and start back on the control column to get the nose wheel off the ground."

We picked up speed slowly. At 48 inches of boost, Pinke locked the throttles. At 70 mph, I switched from the nose steering wheel to the elevator control and pried the big nose wheel off the ground.

Half way down the runway we were in the air and I leveled out slightly and let the speed pick up to 120 mph. Then the gear came up and we picked up speed immediately to 140 mph.

Just as soon as we flicked over the far boundary lights, Pinke hollered across the wide cockpit, "You're on instruments from here on out."

While I "drove the gages," the Tiger Captain made a fast check of the engine instruments and cracked open two cowl flaps to cut down soaring head temperatures. The CAA's "good book" says that the flaps on a DC-4 shall be retracted at 1,000 feet on night take-offs, but our four engines were getting hot from the slow speed and high power output, so the flaps came up just a hair early.

As the flaps come up, there's a very definite change in attitude and you've got to really "horse" back on the control wheel to maintain that 500-fpm rate of climb.

We picked our way around the scattered cumulus clouds and climbed to our assigned altitude, 8,000 feet. Weather briefing showed storms ahead but clear weather at our destination, so we settled back on course and turned on "George," the automatic pilot. Without this gyroscopic instrument, long-range flying would be a tiring proposition. Once you set up the autopilot, all the flying you do is keep the plane trimmed out and change the compass heading once in a while. There's a little bearing friction in the gyro itself and the ship may swing as much as 3° in 10 or 15 minutes.

After we'd been out for an hour or so, Ed Pinke yawned. "Those Wake Island mosquitoes kept me awake last night," he said. "You know how the fuel system works, so don't run the gas tanks dry. I'm going back and take a nap."

There are two double-decked bunks in the crew compartment just back of the flight deck on most DC-4's and everyone in the crew but the radio operator can go back between "watches" and take a quick cat-nap. On these long over-water hops, this chance to stretch out helps relieve the strain.

It was dark and lonesome up front after the moon went down. Without the outside illumination, it was impossible to pick our way around the spotty cumulus clouds that towered to 10 and 12,000 feet and we'd plow through one every few minutes. Finally we hit the reported storm front and the clouds were visible occasionally, lighted by fleeting bits of blue lightning.

When we were fully in front, there was nothing but solid weather. It wasn't extremely rough, but it was plenty wet. Water hissed against the windshield and leaked in around a couple of small cracks in the glass. The head temperatures dropped after their steady wetting, but they stayed in the green with the cowl flaps practically closed.

Back in the Navigator's compartment, Blair Johnson worked away on a dead-reckoning "fix" with his computer. There wasn't a chance at a star-shot and the Loran had so much "grass" on the scope from the downpour outside that it was temporarily useless.

The turbulence increased, and so did the water. A leak around the astrodome left a big puddle on the floor back of the flight deck. Finally the tossing of the big DC-4 woke up Ed Pinke and he stuck his head up into the cockpit.

"Wet, isn't it?" he grinned.

Don Tyson handed up a penciled slip of paper with the latest Tokyo weather. It was clear at our destination, but it was still plenty soupy where we were.

It's an awe-inspiring lonesome experience, this being a thousand miles from land in the middle of a stationary storm front, and your airplane indicating 170 mph. You're all alone except for that loaded instrument panel.

For the regular flight crews, this run is just hard work. It's a lot of painstaking, double-checking procedure with no room for mistakes. The lack of accidents among the contract carriers speaks only the highest praise for the regular flight crews. Any group of pilots, navigators and radio operators that can fly day after day—and nights too—over this barren ocean and always wind up at their pin-point destination in such a routine way are a credit to both their profession and their Country.

Slowly the weather improved and we began to see the false dawn as the sun crawled slowly up behind us. Mt. Fujiyama was visible in the mirky greyness and our Navigator put away his equipment. I went back for a cup of coffee from the gallon jug—and a chance to stretch a bit.

Back on the flight deck, Ed Pinke was busy doing paper work so I climbed back in the driver's seat. "Better start your let-down about here. You're only 30 minutes out," said Johnston.

The power came back and we twiddled with the up-down knob on the autopilot. A glance at the "cruising-descent" check-list showed that the four blowers (superchargers) should be operated for five minutes, so we cut them in one at a time.

We let down over the Bay of Tokyo and circled once over the busy Haneda Airport (Elevation—7 feet). Square-sailed junks

(*Continued on page 45*)

Ready for Winter?

(*Continued from page 28*)

seize in cold weather must be replaced by lubricants with favorable low-temperature properties. There are many such lubricants available, many of them covered by Army and Navy specifications. In some places, finely powdered dry graphite may be used in place of oil or grease.

Graphite can be used on all links in retractable landing gear mechanisms except the worm gears. These gears should have all heavy oil and grease removed, then be relubricated with a very light low-temperature grease. Control cables and links should be wiped with a rag saturated with light oil. This will remove the heavy grease or oil, yet leave a protective film of light oil. The swivel on the tail wheel should be cleaned and lightly oiled.

In most cases, preheating will simplify engine starting. The old standby—a plumber's blowtorch—will serve very well for this purpose. The exterior of the engine should be thoroughly cleaned of oil and grease before preheating is attempted, as such accumulations constitute a fire hazard.

When a nose tent is used, the blowtorch should be placed slightly forward and about three feet below the engine. Never use more than one torch as a second torch might go out and fill the enclosure with atomized raw gasoline. This vapor would then be set afire by the other torch. Better heat control can be obtained by conducting the heat from the blowtorch into the nose tent through a section of ordinary stovepipe. When this set-up is used, the input end of the stovepipe should be baffled for better heat distribution. When engine preheating is contemplated, always "run out" the engine when stopping it. This will empty the carburetor and there will be no danger of the heated fuel expanding and running over, thus creating a fire hazard.

In very cold weather, it may be necessary to drain and preheat the engine oil. Use a clean container for this. A bit of preventive maintenance may be exercised at this point by examining the bottom of the container for metal particles after the oil has been returned to the engine. Such particles would indicate that something inside the engine was suffering undue wear.

It should be remembered that the output of a storage battery can drop more than 50 per cent under extremely cold conditions. Battery strength can be restored by slow heating, or by rapid charging for a few minutes. Never heat a battery rapidly as softening of the various battery structural compounds may occur. Full battery strength is necessary for optimum ignition during starting in cold weather.

Leave carburetor air heat off during starting to avoid injury to the heater by backfire. The spring-loaded blow-by valve in the air scoop should also be checked to make sure it is not frozen shut. If the engine does not start and fire normally after preheating, and when operation continues to become more erratic, check for ice across the spark plug electrodes. This ice can form very quickly if moisture caused by preheating is present.

Over-priming is a common cause of difficult engine starting. Over-priming also constitutes a very real fire hazard. Pumping the throttle at "full rich" on some engines will cause fuel to drain into the air-intake chute and out through the chute drain. This raw fuel may be ignited by a backfire. Fire may occur also in the carburetor air duct, and in some cases may not be visible externally. These air-duct fires can often be extinguished by opening the throttle and turning the engine with the starter.

In very cold weather—below 30°—the engine should not be allowed to idle after landing. Under idling conditions, the oil will soon drop below minimum operating temperature. It will stay warmer much longer if the engine is stopped and covered.

Without proper attention, the fuel system can offer a lot of trouble. All water traps and gasculators should be cleaned regularly. The carburetor should be inspected and adjusted before cold-weather flying starts. When possible, the fuel tank should be kept full at all times when the airplane is not in use. Under cold-weather conditions, moisture in the form of hoar frost will gather on the uncovered internal walls of the fuel tank. When the fuel is sloshed about, these hoar frost particles are washed away in the form of ice particles. These particles will often restrict and sometimes completely block the flow of fuel.

Brakes can cause a lot of trouble in the winter time. The best over-all rule is to not use the brakes or depend on them unless absolutely necessary. Hard use of the brakes generates heat, and water formed in this manner may subsequently freeze between the lining and drum or in the actuating mechanism. When it is suspected that this has happened, continue taxiing the airplane, using the brakes only lightly, until they have cooled belowing the freezing point.

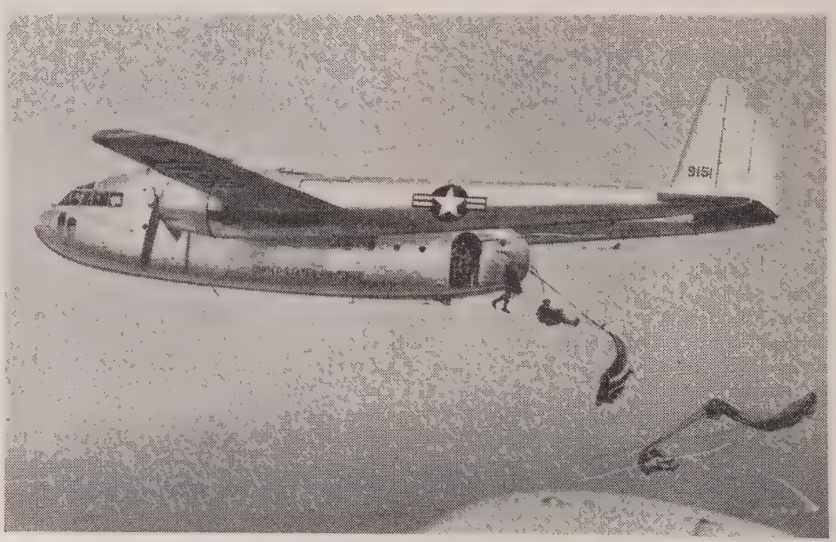
Sometimes brakes will pick up enough water on a slushy runway to freeze during subsequent flight. When this danger is prevalent and flying is necessary, the best thing to do is be prepared for a locked wheel landing. It may not occur, but if the pilot expects it, he won't be taken by surprise. Never leave parking brakes locked when the aircraft is on the ground. Under extremely cold conditions, and especially if the hydraulic fluid is of too low a viscosity index, the brakes may remain on despite manipulations of the control.

It is dangerous to attempt a take-off with frost or snow frozen on the wings, control, or stabilizing surfaces. Even a very thin layer will seriously affect flight characteristics of most airplanes. In medium cold weather, it is possible to remove such accumulations by two persons see-sawing a rope back and forth across the surface. In below-zero weather, it will often be necessary to use a dull scraper. Frozen accumulations on propellers should be entirely removed before the engine is started to avoid unbalance and consequently severe vibration.

Operation of the carburetor air heater during flight is almost necessary at temperatures below 20° to obtain proper mixture distribution. How much heat to use is best determined by experiment. Try several settings and observe engine operation. Remember, however, that each new setting demands a corresponding adjustment of mixture control.

It requires some experience to properly interpret initial oil and temperature gage readings under cold-weather conditions. When starting engines which have not been firepotted, or in which the oil has not been preheated, the oil-pressure gage will seldom indicate pressure at first, but will gradually remove to or beyond the correct amount. This is normal. But if at this point the engine is stopped or reduced to idling speed and the oil-pressure gage fails to drop accordingly, it is a good indication that congealed oil is present and that the engine bearings are not receiving proper lubrication. This is a good check to make prior to taking off. Failure of the pressure gage to indicate any pressure after a few moments of operation also indicates congealed oil or a system blocked by frozen moisture.

In some respects, oil-temperature gages are more reliable than oil-pressure gages during the warm-up period. When the oil has been preheated, the temperature gage should indicate a temperature rise soon after the engine



PARATROOPERS of the 11th Airborne Division leave one of 90 Fairchild C-119 *Packets* in mop-up operations in Korea. In this photo the first five men of a stick of paratroopers are shown leaving the jump door of the airplane. The *Packet* has been used extensively in Korea for workhorse operations, delivering men, weapons, etc.

has been started. This will indicate pumpability. When the engine is started with cold oil, the temperature gage will not indicate a temperature rise fore some time. Watch temperature rise during warm-up to see that it is normal. In some engine installations, a temperature rise will occur due to engine heat conduction rather than proper oil circulation, but in this case an erratic pressure gage will usually give warning.

During landings in cold weather, sufficient power should be left on to maintain cylinder head minimum operating temperature. If the heads become too cold, the engine may fail to "take" when the throttle is opened. Also, minimum head and oil temperatures should be attained before any attempt to take off is made. Many pilots have come to grief because of ignoring this important rule.

Even radios may be affected by extremely cold weather. Congealed grease in control shaft housings and gear cases, frozen dry cell batteries, or a change in capacitance, inductance, or resistance are a few examples to mention. The entire radio installation should be checked by an expert prior to cold-weather operation, and his recommendations should be followed implicitly.

Unfortunately, airplane skis that are best under all conditions are not available. Skis for landing on glare ice would be dangerous if used for deep show landings. The type of landings that will have to be made should be known before skis are purchased and installed. When several types of landings will have to be made, consult an expert concerning the best type of ski to buy.

The major problem in ski operation is maintaining a high degree of slipperiness between the ski bottom and the snow. Quite often, snow will freeze to the ski and must be scraped off prior to the take-off. In loose snow, this may be accomplished by seesawing a rope back and forth under the ski. On ice or hard snow, the pilot will have to use his ingenuity. After removal of the snow or ice, slipperiness may be increased by taxiing the skis across kerosene-soaked rags.

Skis should be rigged with a considerable angle of incidence to avoid stubbing when feeling for a landing under conditions of broad snow and no shadows. On some ski installations, the shock cord and safety line are attached to the same upper and lower fittings. It has been found safer to install these lines as separate units. When the airplane will be parked for a considerable time, the skis should be left resting on boards or poles to avoid direct contact with the snow.

One danger in cross-country winter flying is that while a pilot may be able to walk away from a forced landing, he may freeze to death in doing so. If you are flying over isolated territory, a flight plan should be filed so that a search can be immediately started in case of non-arrival. Furthermore the airplane should have some vivid markings to make it stand out against the snow. This will facilitate air search for a downed plane.

Offhand, it might seem that a number of problems are involved in safe, cold-weather flight. But as previously noted, these are more of an inconvenience than a problem. If such inconveniences are cheerfully accepted and performed, if the pilot will revise his operating procedures to encompass cold-weather operating precautions, he can take to the air with all the confidence he would feel on a fine summer day.

Tokyo Airlift

(*Continued from page 43*)

filled the bay and C-54's jammed the parking area on the field. Turn-around time here is four hours, and that includes unloading, refueling, maintenance if any is required, weather briefing for new eastbound crews and re-loading if necessary.

Landing a loaded DC-4 is just like landing a *Cub* except that there's a little more to set up and your "eye-level" is about 20 feet off the ground in touch-down position. Gear-down speed is 144 mph and you can use as much flap as you need, depending on the height of your approach.

"Keep 140 mph all the way down the final," said Pinke. "Then come across the warm-up circle at 130 and hold it off, just like any other airplane."

The landing approach was fine, but I didn't start back on the wheel soon enough and Pinke hollered, "Hold it off," as he gave an assist on the control wheel. Any lightplane would have been 20 feet in the air when our big dual tires touched down.

It's a long hop. If we'd gone the other way from Burbank, we'd have been beyond Paris. Yet no one came out to meet the airplane when we cut the switches in front of the terminal. There was so much airlift traffic into Tokyo that one more airplane—with its rush cargo—didn't seem to make too much difference.

That isn't true in the air around Tokyo. A radar screen dubbed "lightning" keeps meticulous track of any aircraft in the area. Fighter planes parked on the airport and anti-aircraft pits in the parking area are a constant reminder that these high priority cargos are needed for a vital job.

"What time did we land?" asked Ed.

"Do you want it in local time, Wake time, Honolulu time or 'Zebra' (Greenwich) time?" asked Johnston. You need about four watches on this trip.

"And what day is it," asked Tyson. "We dropped a day between Honolulu and Wake Island when we crossed the International date line. Does that make it Friday?"

We cleared in through Customs where our passports were checked. We changed some American dollars into "Mickey Mouse money," (American Occupational Currency) and headed for downtown Tokyo.

Best summary that I found for this Pacific Airlift came from a pilot stationed at Haneda. "When we need something here for Korea, we need it now—not next month. And the only way to get it here is by air."

Competition is naturally quite keen between the 17 different contract carriers—and the Military Air Transport Service. As more and more MATS planes and crews are available, the contract carriers are being reduced.

Commenting on the part that the Flying Tigers and the other contract carriers are playing in this airlift, Major Phil Schwartz, public information officer at Hickam, said, "They were ready when we needed them—and they've done a fine job."

As long as there are men and machines that can produce an effort like this—from Frankfort to Berlin, from San Francisco to Tokyo or from your hometown to any spot in the world and back, there's quite a future for this nebulous thing we call "Western civilization."

CHRONOGRAPH WRIST WATCH

Lifetime Guarantee
(EXCLUSIVE OF PARTS)
3 DIALS
5 HANDS
2 BUTTONS
$7.50 Plus Tax

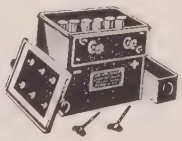
Multi-purpose watch that measures distance, speed, time, moving objects. Used as Stop Watch or Timepiece. Has Sweep-Second Hand for full 60 Second count. Second Dial records up to 45 minutes. Third Dial then records up to 6 hours. Seconds—Minutes—Hours, all recorded automatically.

INDEFENDENT MOVEMENTS
For sportsmen, professional men and women—timekeeper works when other hands and dials are stopped—separate movements permit dual use at same time.

RUGGED CONSTRUCTION
Precision workmanship and shock resistant features are added to enhance the value of this watch. Sold everywhere for as high as $17.00. Our low introductory price is only $7.50 plus 10% tax. (Total $8.25.) Send check or money order and we prepay postage. Or sent C.O.D. plus charges. LIMITED STOCK!

MARDO SALES CORP., 480 Lexington Ave., Dept. C-998, N.Y. 17, N.Y.

New Exide Batteries
For Light Planes—Supply Limited—Order Now!



12 volt, dry-charged. Fully guaranteed. 26¾ lbs. filled. 8½"x5¼"x8½" high. Suitable for all light aircraft including Cessna 140, Supercruiser, Ercoupe, etc. Ideal for new installations. Shielded metal case. No box necessary.

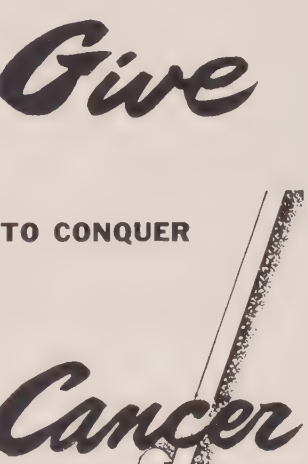
SPECIAL $14.95 each

GAARE SUPPLY CO. Dept. D
Box 277 Weatherford, Texas

Manufacturers' Agent Aircraft
(Executive Passenger and Cargo)
Also
Component Parts and Instruments Including Radio
"Prehy" Airport Equipment, Domestic and Foreign
Aircraft Purchasing and Service Co.
99 Hudson St. New York 13, N. Y.

ENGINEERING DEGREE IN 27 MONTHS
INDIANA TECHNICAL COLLEGE
ENGINEERING: B. S. DEGREE IN 27 MONTHS. Aeronautical, Chemical, Civil, Electrical, Mechanical and Radio Engineering (inc. television). Drafting, 1-yr. Gov't approved for G.I.'s. Low rate. Earn board. Large industrial center. Students from 48 states, 21 countries. Demand for graduates. Enter March, June, Sept., Dec. Write for catalog. 211 E. Washington Blvd., Fort Wayne 2, Indiana.

Give
TO CONQUER
Cancer



AMERICAN CANCER SOCIETY

HANGAR FLYING

Aviation Safety

Accident analysis by the CAB Bureau of Safety Investigation bears repetition. Pilot error was the primary cause of 80.5 per cent of the second group of 1,000 non-aircrarrier accidents analyzed in 1950. This compares to 76.2 per cent of the second 1,000 analyzed in 1949.

Miami Air Show

Miami's All-American Air Maneuvers will not be held this winter, but there's another private pilot's show in Miami to take its place. Sponsored by the Florida Air Pilots' Association, the two-day (January 6, 7) air show will have "Civil Air Power" as its theme. Included in the events at the air show will be a series of stock plane races open to sportsmen pilots, and a national aerobatics competition. Rodney Jocelyn of Langhorne, Pa., will be on hand to defend his title won last year at the All-American Air Maneuvers. There will also be the Miami-Havana Air Cruise (on January 8).

International 99's

The first International Section of the 99's, an organization of licensed women pilots, was gathered into the fold this past fall. Sponsored by the New York and New Jersey Section of the 99's, the Canadian 99's was presented its charter in ceremonies at Ottawa, Canada. Governor of the Canadian Section is Mrs. Phyllis Klotz. There is a second 99 International Section in the making . . . in South Africa.

Seaplane Base Building

If you're interested in developing your own seaplane base, you'll want a new publication released recently by the Civil Aeronautics Administration. Called "*Seaplane Facilities*," this booklet contains answers to many problems posed by the planning and construction of seaplane bases. The book is illustrated and contains charts and tabulations to help those planning seaplane bases. If you want this booklet, write U. S. Govt. Printing Office, Washington 25, D. C., and send 25 cents.

New Goodyear Amphib

A new experimental four-place amphibian, a development of the three-place GA-2, has been demonstrated by Goodyear Aircraft before government observers representing the Navy, Marine Corps, Army Air and Ground Forces, Coast Guard and Civil Aeronautics Authority. Powered by 185-hp engine mounted in a pusher nacelle above the hull, the GA-22 is an all-metal flying boat featuring the new planing tail-type hull, fully retractable landing gear, partial span leading edge slots and slotted flaps, reversible variable pitch prop and crosswind landing wheels. The GA-22's cabin permits quick conversion from all-passenger to an all-cargo payload.

AIRCRAFT INDUSTRIES ASSN chart shows shipment of personal aircraft during September

	Complete Aircraft			Manufacturer's Net Billing Price		
	Shipments			Shipments		
	TOTAL Jan-Sep	September	August	TOTAL Jan-Sep	September	August
				(thousands of dollars)		
Aeronca						
Champion 85 hp	22	--	--			
Champion 90 hp	66	13	11			
Superchief	8	--	--			
Sedan	42	5	4	341	48	43
7FC	1	1	--			
7CCM[a]	7	1	4			
Beech						
Bonanza	342	37	47			
D-18	17	2	4	4,437	514	721
Bellanca						
Cruisair	5	1	1			
Cruisemaster	47	11	11	391	91	88
Call Air - Call Air	6	--	--	30	--	--
Cessna						
140A	251	27	23			
170A	453	60	36			
190	35	5	3	3,857	470	297
195	79	9	5			
Engineering & Research						
G	16	3	4	52	10	13
Luscombe - 8-F	12	3	9	34	8	26
Mooney - M-18	45	6	6[b]	70	11	10[b]
Piper						
Cub Special	3	--	1			
Vagabond	1	--	--			
Clipper	11	--	1			
Tandem Trainer	361	49	63	2,765	241	366
Pacer	530	40	68			
Stinson	73	--	--			
Ryan - Navion	193	17	41	1,976	190	456
Taylorcraft						
Sportsman	19	2	1	41	5	3
Texas Engineering						
Swift	17	1	1			
T-35[a]	1	--	--	78	4	4
TOTAL	2,676[b,c]	293	344[b]	14,107[b,c]	1,592	2,027[b]

a/ Military type aircraft sold to other than U.S. Military Customers. b/ Revised
c/ Includes shipments of 13 Emigh-Trojans valued at $35,000. N.A. Not available

CAA Speeds Air Traffic

A plan to speed air traffic in and out of busy airports, already in effect at Chicago, New York, Atlanta, Oakland and Washington, has been extended to Los Angeles and Salt Lake City, with eight other cities to follow.

The new procedure provides for direct radio communication between CAA air route traffic control centers and pilots of aircraft en route to or from the seven airports. Radio contact with pilots en route has, until now, been maintained by the center either through "company radio" when scheduled airliners are involved, or through CAA Interstate Airway Communications stations in the handling of non-airline planes. Because of the heavy volume of traffic at major airports, the time lag in relaying directions from the center has caused delays to traffic waiting to move into the airport landing pattern.

Skytourists

Skytours, Inc., of Swarthmore, Pa., now features 29 hotels and inns offering something special in the way of service for air travelers. Many of these hotels provide either private air strips for personal plane pilots or nearby air facilities and free ground transportation from field to hotel. The Skytours chain of air resorts and airtels are located in Alabama, Arizona, California, Connecticut, Florida, Georgia, Idaho, Maine, Michigan, Minnesota, New Hampshire, New Jersey, North Carolina, Oregon and Pennsylvania. Membership in the Skytourist Club is extended upon application and payment of $15, yearly dues.

News Notes

DURHAM AIRCRAFT SERVICE, INC. announces the opening of a new branch at 21st and D streets, Miami, at International Airport. Bob Myer, formerly of Pittsburgh branch of DAS, is in charge of a complete line of lightplane parts, hardware and accessories for anything that flies.

RYAN AERONAUTICAL has appointed Bruce Smith to position of Director of Engineering. Ryan Aeronautical has "postponed" its production of the 1951 model of the *Navion* to make way for additional military production requirements.

LEAR, INC., of Grand Rapids, Michigan, has appointed C. E. Willis as Chief Engineer. Mr. Willis, who has been with Lear since 1947, succeeds former Lear Chief Engineer R. A. Ruggs who resigned to become President and General Manager of Kilgore Manufacturing Co.

NORTHROP AIRCRAFT has named Lee H. Smith as customer field service manager. Mr. Smith formerly was with Beech Aircraft Corp.

Skyways and Santa...

THE PERFECT TEAM

Let SKYWAYS be your Santa Claus every month of the year! Treat your air-minded friends to 12 issues of the Number One magazine of aviation. Flying features for pilots, planeowners and air enthusiasts . . . test pilot reports . . . latest news of the newest planes, military and personal . . . maintenance tips . . . how-to-do-it's . . . air experiences. All this and plenty more is yours to give in SKYWAYS.

Take advantage TODAY of this SPECIAL CHRISTMAS SUBSCRIPTION OFFER: $3.50 per year for the first subscription . . and ONLY $2.00 per year for every subscription thereafter. $4.50 for TWO ONE-YEAR SUBSCRIPTIONS to SKYWAYS.

Send in the coupon TODAY!

Christmas Gift Subscription Form

SKYWAYS, 444 Madison Ave., N. Y. 22

☐ Please renew my subscription. Your Name _____

Address _____ City _____ State _____

1-51

Gift to _____

Address _____

City _____ State _____

Gift to _____

Address _____

City _____ State _____

Gift to _____

Address _____

City _____ State _____

Gift to _____

Address _____

City _____ State _____

Dilbert

(*Continued from page 30*)

painted during overhaul. The vent was not entirely covered, but it was partially clogged. Shortly after take-off, engine cut out. Repair bill—$750.

c. A dope brush was inadvertently drawn across the vent opening while a patch was being doped around the gasoline filler neck.

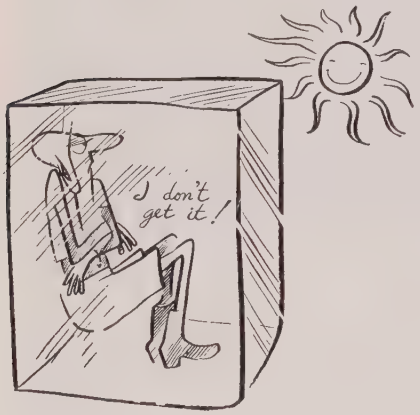
d. The gradual accumulation of dust made sticky by waste oil clogged another vent sufficiently to starve an engine and cause a forced landing in rough terrain.

Grease on a mechanic's hand can plug an air vent and cause engine failure. Be sure your tank-cap vent remains clean and open during any servicing or repair work. Incidentally, tubular vents should always face forward, otherwise they are apt to cause a negative instead of a positive pressure inside your gas tank.

I'm sure, after thinking it over, you will find a good spot to include the gas-cap vent in your preflight check-off list. It only takes a couple seconds.

Ice Follies—Like Sonja Henie, pilots must be ice conscious. Dilbert wasn't until forced down by some that formed in his carburetor. Then he generated enough heat to melt all the ice in Iceland, but it was too late. He insisted he hadn't iced up. "Don't be silly, it couldn't be ice. Why the temperature never got below 60°!"

It is impossible to determine how much Dilbert has forgotten about this subject. My guess is that he never did really understand the why of carburetor and induction system



icing. More important to his life, liberty and pursuit of happiness, however, he didn't know how to prevent this icing.

On the theory that there may be others less ice conscious than Sonja and Dilbert (now), here is a bit of the theory and some preventive advice.

Everybody, including Dilbert, knows about "impact ice." That's the kind you can see. It is formed by snow, sleet or rain at or below 32°F. lodging in the carburetor or some part of the induction system.

"Fuel ice" is more dangerous because you don't see it. It can form on a sunny day with the temperature as high as 80°F. Mainly, freezing occurs due to the large drop in temperature as the fuel is vaporized. There is a further drop in temperature due to the evaporation of moisture in the carburetor system, and still more due to the increased velocity of intake air as throttle is reduced. Total drop from these three causes may be as much as 60°F. Of course, you need water to make ice, so watch the humidity.

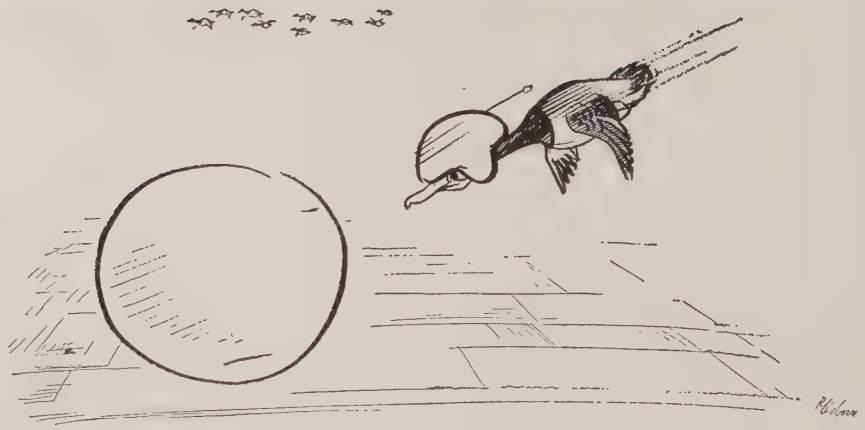
Here are some "*Don'ts*" for small-engine operation:

1. Don't start engine with carburetor heat "on." Pop-back through careburetor may damage preheater.
2. Don't warm up or taxi with carburetor heat "off" when weather is humid and temperature is below 80°F.
3. Don't take off with heat "on." Carburetor heat reduces power, and you may need full power.
4. Don't use a little carburetor heat, followed by a little more and a little more, when icing conditions are suspected. Use full heat and decrease it later, if possible, after power has been restored.
5. Don't give up when carburetor icing persists after preheater control has been set full "on." The efficiency of the preheater is increased by opening throttle wide, putting plane in a climb, and adjusting for a leaner mixture with the altitude control. Diving or any increase of airspeed will dissipate heat more rapidly. Do not, of course, climb into an overcast where icing may be worse.
6. Don't wire the preheater valve in the full "on" position during cold weather. It is possible to ice up in the summer time, and impossible in extremely cold weather.

The best defense against carburetor ice is to anticipate it and never give it a chance to form. For one thing, it takes less heat to prevent it than it does to melt it.

Just another case where "knowledge is safety."

Dive Bombing Duck—I've often wondered why eagles, hawks and other birds of prey do not attack the inoffensive weather balloons which float through their domain. If they ever decide to take up this sport, a certain duck now wintering in the South can give them all the dope. He has had experience.



It happened last fall at an airport in Minnesota. Aerology released a weather balloon for observation and followed it through the theodolite up to 4,000 feet. At that point a formation of ducks appeared upon the scene, heading south in V-formation. They had considerable altitude advantage over the balloon and, believe it or not, one of the ducks in the rear echelon was seen to peel off and dive at the balloon.

Mind you, this wasn't a gentle glide; it was a full throttle power dive. And the aim was perfect! When that duck hit the bull's-eye, the violence of the explosion stopped him with what must have been a deceleration of at least 12 G's. The duck didn't lose its wings, but it must have blacked out, for it went into a spin. It recovered after four turns, and when last seen was slowly climbing to rejoin formation.

If this was an isolated case of flat-hatting, it isn't too important. On the other hand, if it presages a new attitude of the duck world toward balloons and things, it presents serious complications. We won't know the answer until the ducks fly north again.

SETH'S SAFETY QUIZ

1. Why is an engine with an excessively rich idle mixture potentially dangerous?
2. How can you detect carburetor icing by reference to your instrument panel?
3. What are the first three things you should do to regain fuel suction if a tank is run dry in flight?

ANSWERS

1. Excessive idle mixture causes spark plugs to foul, which causes loss of power during take-off, which causes loss of power during take-off.
2. By a loss of manifold pressure while flying at a constant altitude and constant power setting.
3. 1. Shift to proper tank.
   2. Use auxiliary feed pump.
   3. Retard throttle to starting position.

PHOTO CREDITS

Page 6—Jacobs; 8—US Navy, Acme; 10, 11, 12—Wm. Green, Roy Cross; 13—Brennan; 14, 15—Associated Press; 16, 17—Pratt & Whitney, US Navy, Martin; 18, 19—Neal; 20, 21—USAF, 22, 23—CAA; 24, 25, 26—Downie; 27—Demie; 28, 29—Associated Press, Groenhoff, Stinson, Beech; 35—Northrop; 36, 38—British Info; 39—Wide World; 40—Piper; 42—Martin; 43—Downie; 44—Fairchild; 46—AIA; 56—CAA, Collins Radio; 58—Lear; 59—CAA; 60—Aircraft Radio Corp.

Russian Air Force

(*Continued from page 36*)

bombing carried on by the Russians.

Quantity manufacture of the B-29 with all its complex remote-control gun laying and electronic gear will have set the Russian aircraft industry a unique production problem. Consequently, the original design may have been simplified internally, and the remote-control defensive system replaced by manual control of the turrets. The Tu-4 now forms the basis of Russia's long-range striking force, but it is one thing to possess large quantities of modern heavy bombers and another entirely to operate them effectively. Both Britain and the USA learned the effectiveness and the limitations of the heavy bomber the hard way. Russia has had no such experience. While she is rapidly building up her striking force of Tu-4's, the associated navigational problems and target finding and marking techniques present a far more difficult problem—a problem which in times of peace may take many years to solve. The finest aircraft and equipment are of little use without adequate navigational and radio aids which, until they have been tried under true operational conditions, must remain to a certain extent unknown factors.

On a one-way trip only, and with a medium load (such as a single atom bomb), a Russian Tu-4 could reach North American cities and industrial areas via the polar regions (assuming a maximum range of 4,500 to 5,000 miles with bomb load largely replaced by fuel). Such suicide raids would pay dividends and would necessitate a stripped version of the Tu-4 with light armament and reduced crew. All of Western Europe and the vital Middle East areas would be within normal range of the Tupolev Tu-4. It is likely that the Russians will develop the Tu-4 along B-50 lines and standardize on the fundamental design for their long-range groups.

Tupolev's most successful wartime design, which won for him a Stalin Prize in 1943, was the Tu-2 attack bomber. By wartime standards, the Tu-2 was a very good weapon for its job and, by Soviet standards, perhaps their best. It is believed that there are approximately 1,000 Tu-2's still in operational service with units of the Russian Air Force, and the machine is still regarded as first-line equipment. A specialized ground attack variant, carrying a high-velocity 53-mm gun for anti-tank work offset to port in a redesigned solid nose, has recently entered service.

Another redesign of the basic Tu-2, the Tu-6, has made its appearance in the form of a high-altitude radar-equipped reconnaissance bomber-cum-night fighter. The Tu-6 differs from the Tu-2 in having wings of considerably greater span, higher-powered engines, a radar scanner in the nose and larger tail fins and rudders.

However, the talents of this very versatile designer could hardly be wasted upon airscrew designs in a jet era, and after gaining some experience with a four jet-powered research version of the TB-7 bomber, Tupolev, still re-hashing his Tu-2 design, produced an experimental twin-jet attack bomber which is believed to be designated Tu-8. This redesign was flying as long ago as 1947, and many Tu-2 features, such as the tail assembly and wing shape and positioning, were exactly reproduced in the turbojet-powered airplane. Departures were to be seen in the lengthened, slim forward fuselage to accommodate a prone bombardier, and the installation of a nosewheel undercarriage. The unusual length and slenderness of the turbojet nacelles was a noteworthy design feature. These nacelles obviously accommodated axial-flow units of M-003 or M-004 types.

However, it would appear that this machine did not entirely satisfy the Reds, as the latest progeny of the basic Tu-2 design is almost completely redesigned. This airplane, reported as the Tu-10, is known to be in quantity production in the Soviet Union and is now beginning to enter service with first-line combat groups. A sleek, shoulder-wing monoplane spanning some 70 feet, the Tu-10 is comparable to Britain's English Electric *Canberra*, and is undoubtedly among the best of the Soviet's current crop of jet combat types.

Powered by two axial-flow turbojets housed in lengthy, square-section nacelles, the Tu-10 is a three/four seater, featuring a circular-section fuselage, straight-edged square-cut wing, and sweptback tail unit. A tricycle undercarriage is fitted, the main members of which retract into bulged housings in the engine nacelles and the nosewheel into a housing aft of the bombardier's position. The pilot is seated under a bubble-type canopy and a tail gunner, no doubt using a free-mounted 20-mm cannon, is carried. The use of a tail gunner indicates that the Reds do not intend to rely on speed in order to evade fighter interception. Again, this tail gun would prove useful for strafing roads, etc., bearing in mind the Tu-10's ground attack role. A fuselage bomb bay no doubt carries a useful load and, all in all, the Tu-10 appears to be a thoroughly workmanlike airplane in the best Soviet tradition, eminently suitable for short-range tactical work.

Reports indicate that the axial-flow jets provide upwards of 4,000 pounds thrust each and, with an estimated all-up weight of some 30,000 pounds, the Tu-10 should find no difficulty in clocking 520 to 540 mph at low altitude. Range is probably something less than 2,000 miles at a cruising speed of 425 or 450 mph.

Lieutenant General Sergei A. Iliushin, the designer of the wartime series of attack airplanes (Il-2, Il-10 *Stormoviks*) can obviously thank the crack German Arado design team for much assistance in the design of his four-jet medium bomber. Reputedly designated Il-16 and comparable with the B-45 *Tornado*, though considerably lower powered, the airplane bears more than a coincidental resemblance to the wartime Arado Ar-234 reconnaissance bomber, which showed so much promise. Such features as the tail unit, wing layout, fuselage shape, nose compartment and unusual main wheel location in the fuselage, are so similar to the German machine that the Il-16 may be a direct development. Main differences are that the Red bomber is appreciably larger, has four separate turbojets carried beneath the wing on short pylons, and not in paired cowlings as on the Ar-234, and that the rear fuselage extremity appears to include a remote gun position.

Although Arado design features, laid out some eight years ago, appear to have been religiously copied, the Il-16 appears a formidable type, and it is possible that this machine, or a later derivative, has been in production for some time past.

From the foregoing, the reader will see that the Red Air Force is not the vast quantity of obsolescent and semi-obsolescent piston-engined airplanes that many would have us believe. Most disturbing to Western military authorities is the fact that the Soviets have been quick to make up the leeway held by the USA and Britain in combat-airplane design. Having applied the aeronautical knowledge plundered from the Germans to their service designs with startling speed, the Reds are now probably ahead in some fields of research. Their fighters, for tactical work over their own soil under their own special conditions, could not be bettered by production airplanes of any of the Western Union nations. They have first-class jet attack bombers, and it is only in the heavy-bomber long-range field that they seem to be lagging behind. Even these are good. They should be since they were designed in the USA in the first place . . . !

MOVIE STARS Mr. and Mrs. Robert Taylor (Barbara Stanwyck) are shown here at airport in Italy. Mr. Taylor is one of Hollywood's best-known private, military pilots

★ CLASSIFIED ADVERTISING ★

SKYWAYS' CLASSIFIED ADVERTISING RATES ARE 8c PER WORD—FIRST 15 WORDS (MINIMUM SIZE) $1.00

USED PLANES WANTED

POWERS & GEORGE, Aircraft Brokers, of 475 Fifth Avenue, New York City; and, 505 North Ervay, Dallas, Texas, have purchasers for all types of aircraft. No charge for listing your ship for sale. Write for details, describing your airplane.

AIRMART AIRCRAFT needs immediate listings for our prospective customers, on Champs, Cubs, Cessnas 140-120, Stinson Voyagers, Station Wagons, Ercoupes. Absolutely no charge for listing your aircraft. Airmart Aircraft, 22 W. Madison, Suite 900a, Chicago, Illinois.

USED PLANES FOR SALE

FOR SALE AND ALSO WANTED—Used Aircraft, parts, equipment, and accessories. Free listings. Inquiries invited. Madden-Miller Aircraft Brokerage, Fort Lewis Terrace, Salem, Va.

PERSONAL AND LIGHT COMMERCIAL AIRPLANES, lowest prices, terms. Free inspection on delivery. Southeastern Aircraft Co., Box 2248, University, Alabama.

FOR SALE AND ALSO WANTED—Used Aircraft; free listing. Lenard Aircraft, 505 Fifth Avenue, New York.

BEECHCRAFT

BONANZAS: 21 from $5500. Model 35, #2270VS, has 200 hours. Gyro. Excellent. $6250. Also; late 1949 painted A-35, #8802 AS, with 360 hours. E-80 starter, Thompson pump. VHF radio. New. $8800. Apply POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

BELLANCA

CRUISAIRS: 16 from $2775. #89897S has small fins. Outside baggage door. 525 hours, 25 since engine topped. New aeromatic. Spinner. Gyro. Extra engine instruments. Narco and Lear VHF. Marker beacon. Painted 1950. Fabric good. Hangared. Clean. $3600. Also; 1947, #73428S, with 225 hours. Aeromatic. Landing light. Flares. Gyro. Radio. October license. Excellent. $4250. Make offer. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

CESSNA

190'S: 4 from $7000. Painted, late 1947, #4658NS, has 290 hours, 61 hour 1950 engine. Stainless mufflers. Landing lights. Gyros. ADF. Beautiful. $9775. Make offer. Apply, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas Texas.

TWINS: 21 from $1200. #4028NS has 19 hours since airframe and propellers overhauled, engines 326 hours. Recovered 1949. Landing lights. Gyros. Radio. Excellent condition. $2200. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

140-1946, #72114, has 495 total hours, metal propeller, mixture control, mufflers, heater, starter, generator, gear extenders, dual brakes, turn and bank, sensitive altimeter, clock, rate of climb, 2-way G.E., loop antenna, 2 earphones, new heavy duty R33L battery, landing light, enameled flaps and ailerons, seat covers, tie down kit, two brand new 28' parachutes. Licensed 'til June '51 all bulletins complied with, never damaged. $1495. or best offer. Earl W. Fox, R.R. #3, Troy, Ohio.

ALL CLASSIFIED ADVERTISING accepted with the understanding that it will be placed in the first issue closing after receipt of order. Classified forms close first of second month preceding date of issue.

All Classified Advertising Prepaid

DOUGLAS

DC-3 TYPES: 15 from $27,000. File #56S is beautiful deluxe passenger 7000 hour airliner, Buffct. Lavatory. Zero time since 8000 hour aircraft, engine and propeller overhaul. Best airline instruments and radio. Automatic pilot. Never surplus. All bulletins. $45,000 delivered. For details consult POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

ERCOUPE

ERCOUPES: 27 from $850. 1946, #97146S, has 322 hours. Metal propeller. Radio. Undamaged. Always hangared. Excellent. $1100. Also; 1947, #3200HS, with 200 hours. New radio. New tires. Latest tanks, nose-wheel, throttle, and trim tab. Undamaged. Hangared. Exceptional. $1450. Apply, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

FAIRCHILD

FAIRCHILD 24, only 600 hrs. total time, 450 since engine major, G. E. receiver, good condition, never cracked, only $2,200. Airmart Aircraft, 22 W. Madison, Suite 900a, Chicago, Illinois.

GRUMMAN

WIDGEONS: 13 available. G-44, #21604S, has 200 hours since overhauled and new 1949 engines installed. New metal propellers. Gyros. Loop. Marker beacon. Two spare propellers and engines included. September license. Bargain. $8500. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

NAVION

NAVIONS: 40 from $4400. Ryan 1948, #4453KS, has 1949 205HP, 283 hour engine. Extra engine instruments. Special upholstery. Controllable propeller. Auxiliary tank. Flares. Landing lights. Hangared. Clean. New plane guarantee. $7000. Also; Super 260, #411S, with 180 hours. Extra tank. Latest propeller. Gyros. New. $12,500. With VHF and omni $15,750. Apply, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

PIPER

CLIPPER 5958H like new 160 hours, hangared, licensed Sept., blind instruments. Avigator 2-way radio, position and landing lights, tachlog, new $4195. Bargain for $2395. L. M. Bingham, Lincoln, Illinois, Phone 599.

CUB CRUISERS J-5, 2 available, NC 27172, McCawley prop, spinner pants, landing lights, new one piece windshield. Licensed to Sept. 1951. Only $550. Airmart Aircraft, 22 W. Madison, Suite 900a, Chicago, Illinois.

PIPER J-3 CUB, on edo floats, 1946, a real buy in a seaplane. Going at only $1,050. Airmart Aircraft, 22 W. Madison, Suite 900a Chicago, Illinois.

REPUBLIC

SEABEES: 21 available. #6862KS, serial #954, has 262 hours. One of last ships built. Southwind heater. No corrosion. May license. Bargain. $1600. Inquire, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

SACRIFICE SALE TO SETTLE ESTATE. Top condition Republic Seabee, $2000. Only 241 total hours. 15 hours from overhaul and relicensing, Sept. 1949. Hangared at Camden, N. J. Airport, under Spartan Aircraft care. Box #5, c/o Skyways.

STINSON

STINSON 10A, 2 available both in good condition, have 2-way radios, flaps, and good fabric. Prices start at $690. Airmart Aircraft, 22 W. Madison, Suite 900a, Chicago, Illinois.

SWIFT

125'S: 18 from $1675. Painted Globe, #71109S, has 265 hours. Engine 213 hours.. New aeromatic, tires, and paint. Landing lights. Gyros. Radio. All bulletins. Hangared. Undamaged. $2000. Make offer. Also; December 1947 Temco, #71285S, with 200 hours. Aeromatic. Radio. One owner. Hangared. Undamaged. All bulletins. Exceptional. $2275. Make offer. Apply, POWERS & GEORGE, Aircraft Brokers, 475 Fifth Avenue, New York City; or, 505 North Ervay, Dallas, Texas.

SWIFT 125 1946, aeromatic prop and hub, heater, sensitive altimeter. G.E. 2-way radio, direct loop antenna, many other extras. Beautiful shape $2,450. Airmart Aircraft, 22 W. Madison, Suite 900a, Chicago, Illinois.

SWIFT 85, 1946 . . . licensed to February 1951. Has G. E. 2-way radio, excellent condition, never cracked. Only $950. Airmart Aircraft, 22 W. Madison, Suite 900a, Chicago, Illinois.

MISCELLANEOUS

1950 FORDOR PACKARD with radio, heater, overdrive, perfect condition, low mileage, to trade for 2-4 place land, float, amphib. Froscher, 77 Lafayette Ave., Maywood, N. J.

PARTS WANTED 1935 Fairchild 22C7D; Wright Gypsy L320 engine. Anthony Violissi, 50 Marlboro, Portland, Conn.

WANTED: Left and Right wing, horizontal stabilizer for '46 Swift '85 or '125. Write R. P. Burnell, 1333 Pawhotas St., Alexandria, Va.

AVIATION EQUIPMENT AND SUPPLIES

AVIATION and Nautical charts now available from our new chart division. We are agents for the U.S. Hydrographic Office and the Coast & Geodetic Survey. Our world wide service includes Aeronautical Sectional, World Aeronautical, Direction Finding, Navigational Flight, etc. (Free Catalog). Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

SUNGLASSES—AIR FORCE TYPE—New Large Meniscus Polished Lenses. Gold plated frames—complete with leatherette carrying case. Money back guarantee. Only $1.10 ea. Special discount 20% lots of 6 or more. Postage prepaid when payment accompanies order. R.A.F. Mfg. Co., SM-1, 7009 N. Glenwood, Chicago, Ill. C.O.D.'s accepted.

★ CLASSIFIED ADVERTISING ★

GENUINE NAVY Intermediate Flight Jackets, brand new, genuine dark brown goatskin leather, bi-swing back, two patch pockets, one inside snap pocket, mouton collar, celanese lining, 100% wool knit cuffs and waistband, zippered front; sewed with nylon thread. Sizes 34 to 46. Price $35.00 each. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

HELMETS: ANH-15 AAF tan cloth, sponge rubber earcups, new $2.00. A-11 AAF kidskin leather, new, $3.45 each. State head size. B2 Pilot Caps, sheepskin lined leather, long visor $2.50. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

E6B Computers, new, metal $7.00. Plastic, new $4.95 or used like new $4.25 each. E6B Manual; navigation study $2.50. Warner Computer-Plotter, new, $3.00; plotter only $2.00 each. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

MAE WEST LIFE JACKETS $3.00 each. CO2 Cartridges 10¢ each. Coast Guard approved Life Vests, $3.00 each. Safety Belts $1.40. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

HEAD SETS: Low impedence, large ear cups, brand new $4.25. Extensions $1.25, Microphones: T17D $4.25, Sherrill Compass, new $5.25 each. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

PILOT BOOTS—New, shearling lined, dark brown leather, zippered, rubber bottoms. Army type $10.95, Navy $13.95 pr. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

BATTERIES & TIRES: Brand new, for all types aircraft. Bargains. Send for free list. Flying Equipment Co., 1641-5 W. Wolfram St., Dept. S, Chicago 13, Ill.

INSIGNIAS, any design, size, colors or quantity. Design colored and tooled into top grade leather. Send sketch for prices. Julie's Leathercraft, Lone Tree, Iowa.

SERVICE MEN, your name, wings and rank stamped in 23 karat gold on leather patch, $1.00 each, 3 for $2.00. Discount on Squadron orders. Julie's Leathercraft, Lone Tree, Iowa.

PILOTS, your name and wings stamped in 23 karat gold on leather patch, $1.00 each, 3 for $2.00. Names only 2 for $1.00. Wings made special for clubs and schools. Julie's Leathercraft, Lone Tree, Iowa.

WRITE FOR LISTING on new *tires, tubes,* and *wheels.* Dealers and Airports only . . . Harmo Tire & Rubber Corp., 804 Hammond Building, Detroit 26, Michigan.

PARACHUTES, two 28′ CAA approved. Seat type, new condition, $30 each or both for $50. Earl W. Fox, R. R. #3, Troy, Ohio.

BOOKS

ELECTRONIC NAVIGATION. Just published. For air or marine navigation. DeLuxe Binding $4.50. Another new text entitled Flight Instructor Oral Examination by Zweng; a must book for the instructor and his student. Price $1.00. Control Tower Ratings are easier if you order Aircraft Dispatcher by Zweng $4.00. Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

AVIATION QUIZ BOOKS—The following outstanding books by Charles A. Zweng lead the field and prepare you for your rating. Included with each book are authentic examinations with new material not available elsewhere. Also included is a late Government Weather Map pertinent to the examination. Why take a chance? Zweng Books include: Flight Instructor $3.50; Flight Engineer $4.00; Link Instructor $4.00; Private & Commercial Rating $3.50; Instrument Ratings $4.00; Airline Transport Pilot Rating $4.00; Meteorology for Airmen $3.00; Aircraft & Engine Mechanic including hydraulics, weight and balance $3.00; Parachute Technician Rating $3.00; Flight Dispatcher $4.00; Civil Air Regulations $1.00; Private Pilot Rating $1.00; Airport Operation and Management $4.50; Zweng Aviation Dictionary $6.00. Aeronautical Navigation $3.00; Practical Manual of the E6B computer $2.50; Ground Instructor Rating $3.00; Flight Instructor Oral Examination $1.00; Control Tower Operator, our Flight Dispatcher covers most of the control tower examinations, $4.00; Leading Airline Executives and Pilots owe their success to early training with Zweng Texts. Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif. (Free Catalog.)

GUARANTEED: Ross Guaranteed Questionnaires are available for all C.A.A. ratings. They carry a full money back guarantee if you fail to pass your exams. Ross Questionnaires have been used by thousands of Pilots, Mechanics and Instructors with success. The frequent revisions insure your obtaining the very latest material. With a Ross Guaranteed Questionnaire you save time, effort, and money. Order direct or from your nearest Dealer. Engine Mechanic $3.00; Aircraft Mechanic $3.00; Both for $5.00; Commercial Pilot $4.00; Flight Instructor $4.00; Instrument Rating $4.00; Meteorology Instructor $2.50; Navigation Instructor $2.50; Aircraft Instructor $2.50; Engine Instructor $2.50; C.A.R. Instructor $2.50; Fundamentals of Instruction $1.00; As a special offer the complete set of the above Questionnaires are priced at only $15.00; Ross Guaranteed Questionnaires are the only books available that include the same Navigation and/or Weather maps that are used by C.A.A. on their exams. Free folder on request. Orders sent postpaid or C.O.D. Ross Aero Publishers, Dept. 1-S, Administration Building, Commercial Airport, Tulsa, Oklahoma.

STUDENTS, MECHANICS, FLIGHT ENGINEERS: "Aero Mechanics Questionnaire" by Ralph Rice. A greatly enlarged and completely revised printed edition, 222 pages of multiple-choice questions, answers, and explanatory notes covering all phases of aircraft and engine mechanics including power plants, carburetion, lubrication, propellers, electricity, woodwork, dope and fabric, sheet metal, welding, rigging, weight and balance problems, hydraulics and civil air regulations based on current issues. $3.98, postpaid, or c.o.d. plus postage. Address: Paxon Publications. Box 479, Lawrence, Kansas.

MAGAZINES (back dated) foreign, domestic arts. Books, booklets, subscriptions, pin-ups, etc. Catalog 10¢ (refunded). Cicerone's Center, 86-22 Northern Blvd., Jackson Heights, New York.

HOW TO BUILD ONE-PASSENGER FLYING PLANES—Manual. Contains complete construction details and drawings. 64 pages. Profusely illustrated. Postpaid $1.00. Roy Bohreer, 304 West Chickasaw, McAlester, Oklahoma.

BULLET RACEPLANE. Homebuilt, Economical, Fast, Light Monoplane. Complete Blueprints $2.00. Corbcraft, 80-S Maxwell, Rochester 11, N. Y.

FLYING THE OMNIRANGE by Charles A. Zweng. New "first edition" fully illustrated, designed to aid the pilot in flying the new Omnirange Stations now being established by the C.A.A. Order now C.O.D. or postpaid. DeLuxe edition only $4.00. Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

BUSINESS OPPORTUNITIES

$250 WEEK REPORTED! Free book "505 Odd, Successful Businesses." Work home! Expect something odd! Pacific-E, Oceanside, Cal.

HELP WANTED

GOOD PAYING JOBS NOW OPEN. Pilots, A. & E., Flight and Ground Personnel, Factory Workers, Construction, all other fields. Confidential reports on who to contact for best opportunities in U.S., South America, Alaska and foreign. Special Crop Dusting opportunities reported. One year registration and advisory service. All for only $2.00. Why take chances—we give unconditional money-back guaranty of complete satisfaction. (NOTE TO EMPLOYERS: Contact us for free use of our registration of all types of skilled and unskilled personnel.) Research Services, Employment Division, Box 426, St. Louis 3, Missouri.

FOREIGN Employment. Construction men, building trades, mechanics, helpers, office men Good workers interested in Foreign Development Projects. Pipe lines, Dams, Power Plants, Roadways, Shipping, Oil refineries, etc. Transportation and quarters furnished: High wages. Listings of firms actively working on projects in Arabia, Persian Gulf, Africa, Alaska, Canada, South America, Europe, etc. Send $1.00 for Foreign Construction Compendium and Application forms, Foreign Service Bureau, Dept. SK-1 (Employment) P.O. Box 295, Metuchen, N. J.

FOREIGN & LATIN AMERICAN EMPLOYMENT. 1951 "Foreign Service Directory" gives up-to-minute facts on military and civilian construction, government jobs, major oil listings, aviation, transportation, steamship lines, mining, importers, exporters, how-when-where to apply, application forms, hot list firms hiring. $1.00 postpaid. Global Reports, P. O. Box 883-SS, Hollywood 28, Calif.

ALASKA—America's Frontier. $1.00 brings 1951 Business Directory, Large Government Map giving Up-To-Date construction projects, current employment information, homestead and highway facts. Hunting-Fishing-Game Rules, Firms hiring and application forms. Alaska Opportunist, P.O. Box 883-SS, Hollywood 28, Calif.

INSTRUMENTS

NAVIGATION INSTRUMENTS: Beautiful new and reconditioned precision instruments. Brand new Link Aircraft Sextants with case $37.50; Fairchild reconditioned $12.50; averaging type, $17.50; Bausch & Lomb Sextants, excellent condition, $49.75; Brunning Drafting Machines $55.00; Navy Stadimeters $24.00; Surveyors Levels $175.00; Seth Thomas Classroom elect. Clocks $14.35; Hamilton 24 hour Master Navigation Watches $65.00; Chelsea 24 Hour jeweled Clocks for Airline Operation, etc., $62.40; 6-inch (new) Pioneer Magnetic Compass $12.95; Pioneer Panel Compass (new) $17.50; Dalton Model "G" Computer (new) $7.50; Weems Mark II Plotter $2.00; Dalton E-6B Computer $10.00; A-2 Deluxe Computer with Case $3.00; American Airlines Computer $5.00; Model "D" high speed $6.00; F-8 Aerial Cameras (new) $185.00; Astro Compasses (new) $12.50; (Free Catalog) Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

(*Continued on page 52*)

U OF I
LIBRARY

CLASSIFIED ADVERTISING

(*Continued from page 51*)

INSTRUMENTS (Continued

WEATHER INSTRUMENTS. Beautiful Taylor Barometer, brass finish $18.00 and up; Temperature and Humidity Guide $7.50; Dr. Krick's handsome Weather Forecaster with compass. Satin metal finish only $12.50; Beautiful imported drawing instruments in German silver, eight piece sets, plush case only $5.50. Airport set comprising Wind Vane, Anemometer, Indicators, etc. $150.00. Barometer for your office only $9.00. Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

COMPUTERS, War Surplus E-6B. Regularly priced $10.00. While they last $4.85 with leather cases. Directions for use including practice problems shipped free with E-6B. Cox & Stevens Navigational Computers model VAW. Regularly priced $35.00. Limited Quantity like new $13.85. Magnetic Compass, War Surplus, Bendix B-16, fits 3¼ inch diameter instrument opening, fully reconditioned. Has built-in night light. While they last $6.85. Postpaid or C.O.D. Money back guarantee. Kane Aero Equipment Co., 2308 N.E. 23rd. St., Oklahoma City, Okla.

INSTRUMENTS — Kollsman Sensitive Altimeters $12.95; Pioneer Turn and Banks $9.95; rate of climbs $6.95; cylinder head temperatures $9.95; 0-300 Airspeeds $5.95; B-16 compasses $5.95; manifold pressures $7.95; suction gauges $2.25; headsets $1.45; hand microphones $1.45. Payment with order. Gaare Supply Co., Box 277, Weatherford, Texas.

WIND SPEED INDICATOR—for home or airport —$49.95. Direct reading in miles per hour complete with cup anemometer, cable, and indoor dial indicator. No external power source required. Install in half hour. Send ten cents for Catalog S, Weather Bureau and amateur type instruments. Science Associates, 401 N. Broad St., Phila. 8, Pa.

INSTRUCTION

NAVIGATOR Rating Examinations included in New Aeronautical Navigation by Charles A. Zweng $3.00; Fairchild Surplus (electrical averager) Sextant $17.50. Pilots supplement your training. Order "Ground Instructor" $3.00 and "Ground Instructors' Rating" $3.00 or both for $5.00; Examinations included. These books by "Zweng" prepare you for increased earning power. Pan-American Navigation Service, 12021-22 Ventura Blvd., N. Hollywood, Calif.

EARN while building radios. Learn television. Experience unnecessary. Parts, tools, instructions supplied. Free details. Federal, 176-71 Union Turnpike, Flushing 9, New York.

MISCELLANEOUS

YOUR Leather Jacket renovated by our craftsmen expertly, reasonably, Request free descriptive circular. Berlew Mfg. Co., Dept. 33, Freeport, N. Y.

WORLD WAR I, II. Aviation books, rare, unusual, new and used. Send 5¢ for list. Airbooks, Box 958, New Rochelle, N. Y.

Selling to the Air Navy

(*Continued from page 37*)

Each invitation to bid has an invitation number and shows the date and hour of the opening of bids. The various items are grouped into "lots" by trades or industries, so that each bidder will be able to quote on every item in the lot, and thus permit as far as is possible awards by lots rather than by items. This simplifies the making of awards and allows small-business concerns an equitable opportunity to compete for contracts.

Navy Department Specifications are those approved by all interested Bureaus of the Navy Department, *i.e.*, BuAer, BuOrd, etc. Upon approval by the Navy Department Specifications Board, their use is mandatory for all purchases made by the Navy.

National Military Establishment (NME) Specifications are those which have been developed and approved by the Army, Navy and Air Force for use in procurement of supplies and materials used by all services. They take the place of the former Joint Army-Navy (JAN) Specifications.

Somewhere between half and three-quarters of a billion dollars of Air Navy procurement for fiscal '51 will go to subcontractors. Here is a golden opportunity for the smaller outfits. (How small is "small?" The Department of Labor defines a "small business" as one whose aggregate number of employees totals less than 500. The Department of Commerce is working out a more specific formula, which the Dept. of Defense will accept.)

If subcontracting is your dish, it is up to you to get in touch with Air Navy's prime contactors in your general area. You deal directly with them and not with BuAer, ASO or any other agency.

For example, one of the principal engine builders for Navy is Pratt & Whitney Aircraft division of United Aircraft Corp., East Hartford, Conn. P. & W. deals with more than 4500 firms, with nearly 2,000 in New England, and another 2,000 in New York, New Jersey, Pennsylvania, Ohio, Indiana, Illinois and Michigan. Others include Grumman and Sperry on Long Island; Glenn L. Martin Co., Baltimore; Chance Vought, Dallas; McDonnell Aircraft, St. Louis; Douglas Aircraft, Santa Monica; Lockheed Aircraft, Burbank; Consolidated Vultee, San Diego.

A letter to the Director, Subcontracts Department (the title will vary, but this should hit close) advising him of the type of work you are equipped to do, information on products you have made, machinery, tools and similar equipment, quality of personnel, capacity of plant, previous experience with aviation products, financial position of your company, etc. may open the door. If your presentation is favorable, a visit to your shop by the prime contractor or a conference at his plant, involving your sales engineer, production manager, etc. may follow.

A final tip. The magazine *Armed Force* has introduced a year-round *Washington Industrial Service* which is well regarded by the procurement people in all three armed services. It consists of a series of explanatory sales books, text of pertinent laws and regulations, weekly salesletter, etc.

There will be *plenty* of business to keep our Air Navy flying for as long a time as we can foresee. It's up to you businessmen to go out and get your share of it. It's there for you if you want it.

Behind the Headlines

(*Continued from page 15*)

of the plane is not to blame for the accident.

The plane accidents described by the newspaper clippings on page 14 were caused by sudden or excessive pull-ups by pilots who had flown into weather they weren't qualified to fly. With those sudden and excessive pull-ups, the laws of nature and kinetic energy took over.

According to the law of motion, when a body is moving, it tends to move in a straight line and it takes force to deflect its course from that straight line. When an airplane is flying a straight course, therefore, a force must be applied to it to make it turn, make it climb, or to level off.

If, while traveling at 153 mph, a pilot makes a sudden or abrupt pull up, perhaps to avoid entering a fog bank or to clear some obstacle, an anti-gravity or kinetic energy load of 5.7 times the weight of the plane is forced on the airplane's structure. If the plane weighs 2600 pounds, for example, the sudden pull-up will impose a load of 14,820 pounds or 7½ tons on the aircraft structure. Also, the higher the entry speed at the pull-up, the greater the imposed load.

Current government design requirements call for a 5.7 G ultimate load factor for personal planes. This is more than enough for common sense flying . . . . and where common sense handles the wheel of a car, the throttle of a train or the stick of a plane, there won't be accidents. As the saying goes, "today's airplanes are fool proof . . . . but not damn fool proof."

In the accidents reported by the news clips, it was this G load that was either ignored or overlooked by the pilots. In making an abrupt pull-out of a dive or high-speed spiral, the pilot caused a load to be imposed on the plane far in excess of the designed load factor of that plane. The result —another air tragedy to headline the newspapers. An air tragedy caused by an erring pilot, *not* by an erring plane.

Today's airplanes are built to meet the utmost in safety requirements. And they have been tested and re-tested to prove their sturdiness and reliability. In the hands of capable pilots, these planes can and do travel more miles in absolute safety than many a motor car. With modern equipment as carefully engineered as today's aircraft, the qualified instrument pilot who maintains his IFR proficiency in the type of plane in which he is to make an instrument flight will not become a tragic headline of tomorrow any more than will the railroad engineer, the taxi driver, or the family doctor driving down the street in his car and using the same good sound judgment.

Remember again . . . . the airplanes and engines coming off production lines today are well nigh fool proof. Don't let the fact that they aren't damn fool proof, any more than is a car, a train, or a bicycle, sell air travel down the stream of bad judgment.

Pilot error is the killer, not plane error . . . . just as driver error is the killer and not car error. According to 1950 records (second group of 1,000), 80.5 per cent of non air-carrier accidents were caused by pilot error. Weather and terrain accounted for most of the remaining 19.5 per cent. Imagine the personal-plane safety record if pilots were as reliable as their airplanes!

VOR evaluation project clinches value of VHF omni-ranges .....page 55

NAVICOM

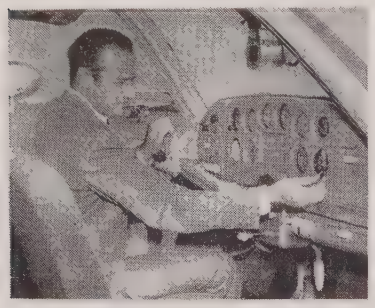
NAVIGATION, COMMUNICATION

Lear Omniscope

Orienter and Omnimatic found to be useful! X-country aids.....page 58

Edited by Col. N. F. Silsbee

Larry Hart KNOWS
SUPERIOR RADIO WORK



L. A. (Larry) Hart is one of the Southwest's best-known and most successful young executives. Hart pilots his own Bonanza airplane which keeps him in close contact with his varied business interests. Here is what he has to say about the job performed by Southwest Airmotive in revamping his plane's radio system.

"The old equipment in my Bonanza was both unreliable and difficult to maintain. Southwest Airmotive analyzed my needs, removed some of my old gear, reworked some of the other, and added an ARC omni-receiver. The system now functions smoothly and safely. Incidentally, I am especially pleased with the fact that ARC gives a full year guarantee on all its new products. As a businessman, I consider this factor an important one in making an aircraft radio purchase."

L. A. HART

HART'S EXPERIENCE IS
Your EXPERIENCE AT..

SOUTHWEST AIRMOTIVE CO.
REPRESENTING ARC AND RCA
LOVE FIELD, DALLAS

Light as a Feather
. . . Clear as a Bell

NEW BANTAM EARECEIVER

Kills annoying static . . . signals come through clear even under the worst static conditions. The Bantam Eareceiver is a pleasure to wear. It's designed to replace old-fashioned, uncomfortable ear-muff headsets.
Ten day money-back guarantee.
See your local dealer today or write for further details.

$7.50
Complete with Three-foot Cord and Jack

DAVE RUMPH COMPANY
"Aviation's Leading Electronic Supply House"
P. O. Box 4178 Ft. Worth 6, Tex.

New Collins Computer for Instrument Flight

Collins Radio Company has introduced an Aircraft Steering Computer (ASC) and associated instruments to provide pilots with steering information to enable them to attain and fly a chosen course smoothly without overshooting or bracketing.

Steering information from the Computer is displayed to the pilot on the Collins Pilot's Steering Indicator (PSI), an instrument similar to a conventional cross-pointer meter. Displacement of the PSI cross-pointers from center indicates to the pilot that the aircraft's heading and/or attitude are incorrect for making good his chosen course and that he should steer left or right, or up or down, according to the direction of the cross-pointers' displacement.

▶ **Instruments vs. ASC.** In conventional instrument flight, it is necessary for the pilot, in order to fly a precise course, to watch a number of flight instruments and to interpret their readings and rate of change in terms of control forces to be applied to wheel and rudder. The ASC is designed to aid the pilot by relieving him of that job of continuously scanning a number of instruments and interpreting their readings. All of the flight data is fed into the equipment which computes the required steering information instant by instant. This is displayed to the pilot on the PSI in the form of deflection of two cross-pointers. To maintain course it is only necessary for the pilot to maneuver the aircraft so as to keep the cross-pointers centered.

In a nutshell—the Aircraft Steering Computer is an item of Collins equipment designed to do about what the extraordinarily successful Sperry "Zero Reader" has been doing for executive and military aircraft.

▶ **ILS Aid.** In addition to the PSI, a heading selector and an artificial horizon are furnished. The equipment is intended primarily as an aid to ILS approach flying. Under these conditions, information regarding aircraft attitude is obtained from the artificial horizon and a gyro compass and line of position information from the ILS radio receiving equipment. Steering information is also provided during enroute flying for maintaining a constant heading, altitude and pitch attitude for making procedure turns.

Potential sources of error have been taken into account in the design of the Computer with the result that accurate steering information is obtained under all conditions. In particular, correct steering information is obtained regardless of crosswind component, and presence of minor disturbances in the ILS beams.

Bantam Eareceiver

The Dave Rumph Company, aviation electronics specialists of Fort Worth, Texas, have recently developed a new "hearing aid"-type receiver highly competitive to the standard ear-pad types now in general use in civilian flying. The new Rumph unit has been trade named the *Bantam Eareceiver*.

The superiority of lightweight "hearing aid"-type radio headsets over the heavy ear-muff type has long been known to radio experts. The main drawback to the tiny hearing aid units has been high initial cost, roughly three times the cost of standard earphones. Another factor against this type of receiving unit is the difference in individual ear sizes.

The new lightweight *Bantam Eareceiver* retails at $7.50, less than a third of the price of similar hearing-aid types. A new, quick-adjusting ear piece makes one model adaptable to all ear sizes.

Weighing less than half an ounce, the *Bantam Eareceiver* is a low impedence-type receiving unit. It operates on a far lower volume level than conventional units. This serves to minimize static even under the most severe static conditions. According to company claims, tests conducted by the Rumph Organization have shown that the new *Bantam Eareceiver* brings in clear, readable signals during periods when cabin speakers and earphones have been rendered practically useless.

With the sound being fed directly into the ear and not against the ear, the low volume required makes the *Eareceiver* ideal for use with DF loops. During periods of precipitation with high rain static on unshielded loops, the new lightweight unit is said to work satisfactorily with the wearer nulling out stations that were impossible to null out with ear-pad type units.

The *Eareceiver* is sold with a three foot cord and jack to permit ample movements by the wearer. Pilot fatigue on long flights or under static conditions is said to be materially reduced through the wearing of this lightweight unit.

Radar and the Pilot

The CAA has recently published a useful booklet entitled Radar Information for the Pilot. It contains a simple explanation as to how the Airport Surveillance Radar (ASR) and Precision Approach Radar (PAR) functions of GCA work, with detailed sections on their operation from pilot standpoint.

An important section deals with the monitoring of ILS approaches, and another gives the techniques to be followed on the new PPI approaches.

The booklet is well illustrated, and may be purchased from the Supt. of Documents, Govt. Printing Office, Washington, D. C., for 10 cents.

Is OMNI Good Enough?

Will the O-B-D system be a stepping stone or a building block?

By Irvin Nye

Is the Omnidirectional range merely a transitional air navigation aid—a stepping stone to the future comprehensive air navigation traffic control system; or is it a fundamental building block for that future system? It is already clear that the omni system is a great improvement and that it will gradually replace the outmoded system of four-course radio ranges which have been the primary navigational aid for many years.

But in order to evaluate its future role, it is essential to understand the advantages and also the shortcomings of the OBD system that's now available. Omniranges are coming into use by the airlines, by the military and by large numbers of private operators. In the west, one network of controlled Omnirange airways has been in use by an airline since October. Other operators may be using them by the time this article is printed.

How adequate are these new airways? How accurate are the readings provided to pilots? Where are the inaccuracies and what causes them? These are the questions which require answers before the operational people can fit omni into its future role.

Test Project ▶ Some of the answers have been provided by a test program recently completed and reported upon by Airborne Instruments Laboratory (AIL), Mineola, Long Island, and cooperating organizations. Sponsored by the Air Navigation Development Board (ANDB), the project tested three Omnirange-Distance Measuring Equipment installations which were selected as typical.

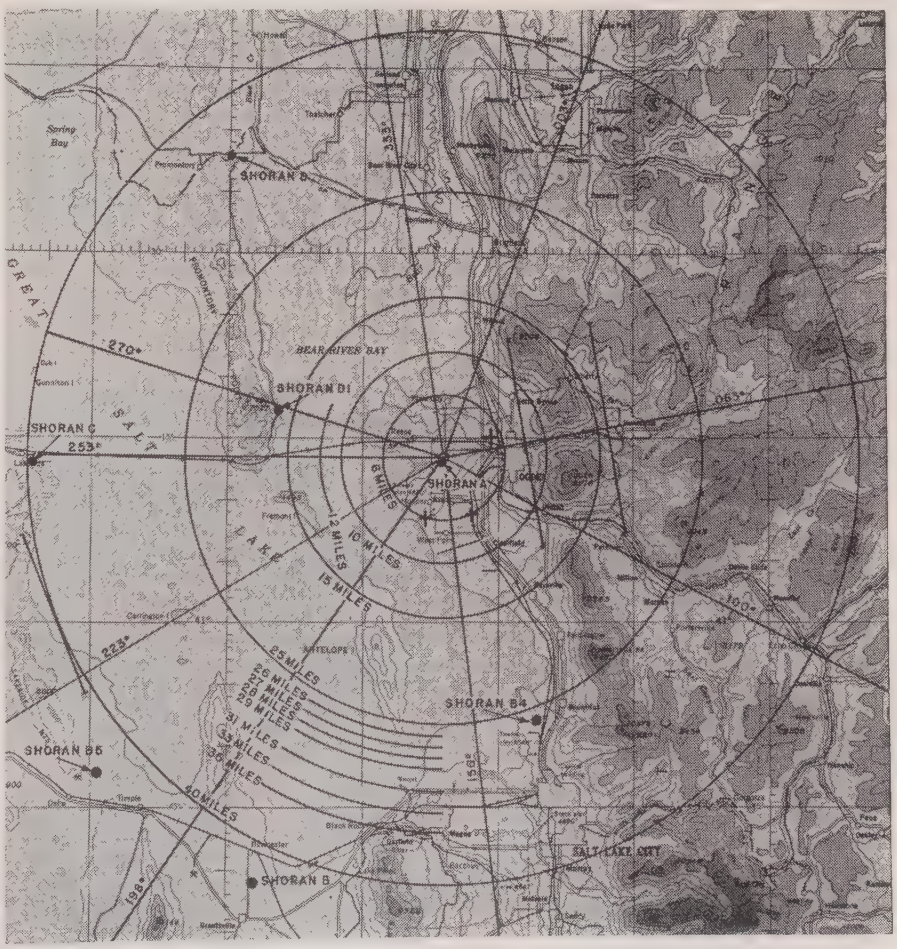
The first installation tested—it was selected as typical of installations having flat surrounding terrain—was the OBD (Omni Bearing Distance) facility operated by the Navy at Patuxent River, Maryland. The ground equipment was adjusted and calibrated by CAA personnel to assure equivalence with other commissioned installations to be tested. The actual tests began in September, 1949, and were concluded at Patuxent by mid-December.

Then the field program moved on to the CAA-commissioned VOR (Visual Omni-directional Range) facility at Philipsburg, Pa. This site had been chosen as representative of hilltop installations having mountainous surrounding terrain. By mid-January, this phase of the work was completed and the project was moved to the commissioned VOR installation at Ogden, Utah, one considered typical of valley sites with mountainous surroundings.

Flight Data ▶ Most of the measurements were taken in a series of flights in an Air Force C-47. The remaining flights utilized a B-17, a Piper *Clipper* and a Beechcraft *Bonanza*. Data were derived mainly by comparing position measurements made with the OBD system against others made simultaneously with *Shoran*, theodolites and ground radar. Over 300 hours of flying time were devoted directly to testing, during which approximately 55,000 photographs were made of special panels in the aircraft—each photograph recording data from a number of instruments related to the flight accuracy and characteristics.

The principal objective of the evaluation program was to determine the accuracy of the navigation information provided by an OBD facility within its coverage area. The procurement data for each installation was essentially a straightforward engineering problem, but the presentation of the data in a manner permitting meaningful evaluation of the present utility and future potentialities of the OBD system proved to be far more complex.

Evaluation difficulties arose because some of the errors of OBD system components—and, therefore, system accuracy—vary with aircraft position relative to the ground station, with topography, with aircraft (*Continued on page 56*)



TOPOGRAPHY near OBD facility near Ogden, with Shoran positions indicated

Is OMNI Good Enough?

(*Continued from page 55*)

attitude and with equipment condition. This made it incorrect to define performance of any OBD installation in terms of any single value. Realistic interpretation of an installation's performance had to include consideration of the effect on aircraft flight of error amplitudes and rates of change, of system coverage and of equipment condition.

AIL's test program provided for the three typical installations studied the comprehensive evaluation required. It studied the VOR aggregate error, which is defined as the actual magnetic bearing of a point of measurement with respect to a ground station minus the indicated bearing provided by the airborne VOR equipment.

It also examined the DME aggregate error, placing particular emphasis upon equipment condition. This was essential, for the equipments used in the AIL tests were early experimental models. Off-Course Computer errors were separated from other factors to permit analysis of all three components.

Results of the Airborne Instrument Laboratory's evaluation project seem to have pretty well clinched the potentialities of the OBD system, in the opinion of qualified judges.

Omni Errors ▶ Large bearing errors were measured in certain regions near Ogden—up to plus or minus 8°. But they varied rapidly with aircraft position and were averaged by relatively sluggish reaction of the aircraft, either with the autopilot or manual control. From the practical standpoint of maintaining a course, they could be ignored. The errors in the actual flight track were more in accord with the ground station and receiver errors—much smaller than peak error values. The total spreads in ground station errors at Patuxent, Philipsburg and Ogden were 5°, 3.1° and 4.4°, respectively.

At present, the accuracy of airborne VOR receivers appears to be directly related to their size, weight and cost. This is evidenced by the fact that the heavier Collins 51R2 equipment gave slightly more accurate readings than two lighter receivers tested, though all functioned normally throughout the tests.

The knowledge gained concerning VOR siting problems has aided the CAA in completing its program of relocating some facilities which initially were sited unfavorably.

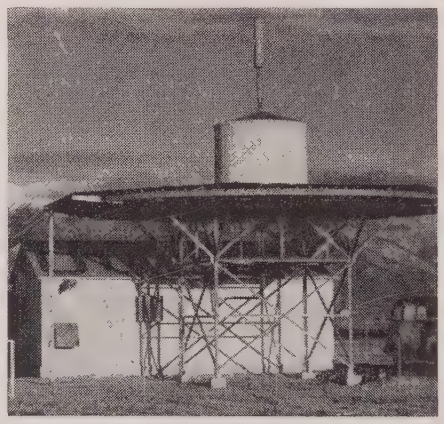
DME Also Tested ▶ Despite the fact that DME and Computer components utilized were early experimental models, test results were better than some experts had anticipated.

DME difficulties—some of which increased normally small errors of a fraction of a mile to as much as four miles at extreme range—may well be discounted in evaluating future potentialities of improved equipment, according to those who conducted the tests. Computers, according to test results, need much attention toward improved reliability.

The most favorable evidence of future potentialities of the VOR system turned up by the AIL study project was that despite the many types of errors affecting the course indication, the actual resulting off-course displacement of the aircraft was never more than four degrees, and was usually very much smaller.

Certain features of the complete OBD system are still relatively experimental, and it is believed that the evidence presented by the AIL evaluation report gives grounds for assurance that with further development many of these difficulties can be surmounted. In this case the system will prove to be not merely a stepping stone of value for a limited period of time, but a building block suitable for inclusion in the ultimate all-weather airways system for military and civil use.

The AIL *Report* was prepared by W. R. Rambo, J. S. Prichard, D. P. Duffy and R. C. Wheeler.



OBD facility at Ogden, showing DME installation, with mountains in background

Isolation Amplifier

One of the most useful of the aviation radio aids for pilots is Aircraft Radio Corporation's type F-11 Isolation Amplifier. Last summer the pilot and co-pilot of a Texas-based Grumman *Mallard* executive amphibian came to Southwest Airmotive for an ARC Type 15B omni installation. They mentioned the difficulties they had been experiencing, *i.e.*, cross-talk and other mix-ups in their audio system. They were convinced that, for real radio utility, the whole panel would have to be reworked. This was done.

▶ **New Panel Set-up.** A small, neat plug-in overhead radio panel provides simplification and consolidation of controls for the omni, VHF communication, ILS and Isolation Amplifier. The F-11, which weighs only 8 pounds, permits all radio functions such as LF or VHF navigation, communications to airways stations and control towers, GCA approaches, etc., to be divided between pilot and co-pilot without cross-cockpit interference. In the accompanying photo, the co-pilot is shown adjusting the audio level on his side of the Isolation Amplifier.

The overhead panel includes two small tuning meters, one assisting in tuning the omni receiver, and the other in monitoring the VHF transmitter output. Frequency tabs for the VHF transmitter-receiver and the glide path may be readily changed when necessary without re-engraving the entire panel.

This SAC-designed panel supplements the *Mallard's* standard radio gear installation, controls for which are on a subpanel below and above the main panel (not shown in photo).

Bendix Radio Division has also developed a similar piece of equipment for eliminating cross-talk in the cockpit.

OVERHEAD panel on *Mallard*, co-pilot adjusting audio level of Isolation Amplifier

Spotting Bad Weather by Radar

With indicated improvements, airborne radar will bring unique aid to flying safety

By FRANK C. WHITE

Operations & Engineering, ATA

Hardly anyone familiar with the operating problems of a transport aircraft will disagree with the opinion that the installation of a suitable airborne radar set would be a major forward step in decreasing the delays now chargeable to thunderstorms, line squalls and frontal weather. Besides decreasing or perhaps eliminating these delays, the radar would undoubtedly contribute to a smoother ride, with an increased safety factor when these types of weather lie across the flight path.

The practical question which has to be resolved is this: What specific operational requirements must an airborne radar fill to be satisfactory for installation in an air transport for the primary purpose of detecting and displaying dangerous weather?

▶ **Requirements.** 1. *Reliability.* The radar must give reliable service, day after day, without numerous failures requiring adjustment or replacement by a qualified maintenance technician.

The electronic equipment now carried in airline or executive transports will give reliable service for 500 or 600 hours before it is removed for preventive maintenance. Though a lesser amount might be acceptable in the case of airborne radar, it is almost certain that an average of less than 100 hours of trouble-free service before removal for adjustment or service would not be tolerated. This requirement should not be difficult of attainment.

2. *Visibility.* The radar set should provide a display which can be viewed under average conditions of surrounding cockpit light.

Here is the number one bugaboo of present-day airborne radar. Though the skipper of a ship may be able to take time, during an approach to a fogbound harbor, to view his dimly visible radar scope through a truncated cone hood and allow time for the iris of his eyes to open to a point where the scope becomes clearly readable, the job in the cockpit of a modern transport aircraft seldom permits this much time to be allocated to this situation. Seconds are valuable in operation of aircraft.

It is possible to use the airborne radar during daylight hours only by employing a truncated cone hood which is fitted over the end of the PPI scope to shield off the surrounding light. In addition to this hood, it is necessary to use colored plastic filters which are fitted to the cockpit windows to reduce the surrounding light to a point where the iris of the eye will open sufficiently to permit the scope to be viewed. The problem of visibility, therefore, appears to be a greater hurdle than that of reliability, but work is going forward to try to overcome it. One possible solution cannot be discussed for the present because it has been applied to military radar developments.

3. *Uniformity.* There must be uniform performance when flying in similar types of dangerous weather, together with a practical method of differentiating between dangerous and innocuous weather.

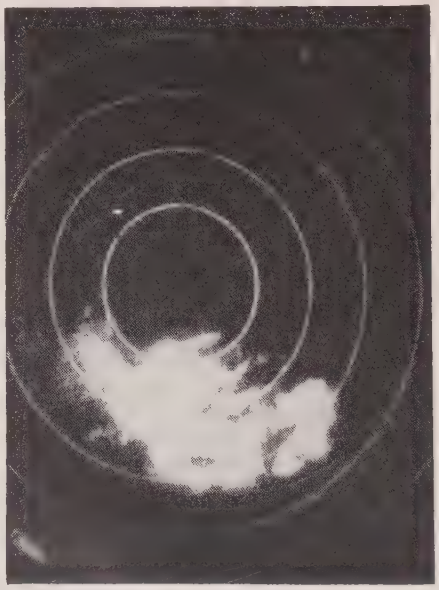
Airborne radar will detect dangerous icing, dangerous cumulonimbus clouds, and dangerous hail. Yet, unfortunately, we cannot establish an operational procedure which will allow us to take full advantage of these features without imposing such severe operating restrictions that an impossible situation results.

For example, take the problem of dangerous hail avoidance. It has been shown that the echo from hail, for all diameters of hail stones that will damage aircraft in flight, will be displayed by airborne radar using any wave-length between three and 10 centimeters. During thunderstorm-probing operations, flying with the Navy near Cheyenne, Wyoming, last June, hail stones of approximately ¾ to one inch in diameter, which gave a well-defined echo on the PPI display, were encountered near a large cumulonimbus cloud. Unfortunately, this echo appeared no different on the PPI display than an area of light-to-moderate rain which would be absolutely harmless to the aircraft. If we instruct the pilot to circumnavigate *all* echoes while flying near thunderstorms, to permit avoiding the hail and the innocuous rain areas as well, we would practically prohibit the completion of many flights that are made today.

In the case of 3-cm wave-length (X-band) radar we are faced with the problem of attenuation of the radar signal by moderate-to-heavy rain. If a radar can be built that eliminates or reduces to insignificance the problem of attenuation, it will materially increase the acceptance and operational usefulness of the equipment (*Continued on page* 60)

CUMULONIMBUS cloud bank over eastern Pennsylvania from a distance of 12 miles. Photo was taken from cockpit of an American Airlines Engineering Div. Flagship

RADAR photo of the same cloud bank taken a few seconds after regular photo



Flying the Lear Omnimatic

Test flight in Bonanza equipped with Lear Omnimatic proves pilots' praise is earned

By Col. N. F. Silsbee

There's no substitute for sight. I had read a lot about the Lear Omnimatic as a low-priced lightweight automatic VHF navigation system for all types of aircraft, from Piper *Pacers* on up. I also had read a good deal about the ADF-12 *Orienter,* Lear's lightweight automatic direction finder, and I'd heard Arthur Godfrey ramble on in praise of the *Orienter* in his *Navion.* However, personally seeing this equipment in action made all the difference. The equipment's usefulness became more than hearsay.

The flight that taught me so much was made in a *Bonanza* equipped with the Lear LTRA-5 transmitter-receiver, *Omniscope,* ADF-12 *Orienter* and CVIX Cross-Pointer Indicator for instrument landings (see left side of panel).

▶ **Lear ADF vs. Standard.** The standard automatic direction finder (ADF) has not been too "popular" among private pilots because the units have been too expensive and too heavy. Quite a number of excellent war surplus ADF sets (such as the Bendix MN26, BC-433, or R5/ARN-7 radio compasses) have been installed in Twin Beeches, *Bonanzas,* Cessna 190/195's and *Navions,* but they take up more weight than a lot of pilots like to carry around for that particular purpose.

The Lear ADF-12, however, weighs only 18 pounds (less than the weight of three gallons of gas), and costs only $695, which is less than the cost of one year's crash insurance for the average four-place plane.

Like any standard ADF, the *Orienter* consists of a motor-driven loop assembly, loop housing, a low-frequency tuner assembly, and an amplifier and azimuth indicator. This combines the functions of an LF radio range and communications receiver, broadcast receiver, and an automatic direction finder on range, beacon and standard broadcast stations.

An important innovation in the Lear *Orienter,* however, is the complete elimination of flex shafting. The ADF-12 is all electric. This means simplified installation, smoother response, and greater accuracy of azimuth indications.

▶ **Test Flight.** Taking off from Washington National Airport, we headed in the general direction of Baltimore. We tuned to 257 kc, the frequency of Baltimore range, and watched the needle on the *Orienter* dial. Within a couple of seconds the Azimuth Indicator pointed to 45°, the correct heading for the Baltimore range, with no question of ambiguity—whether this was "to" or "from" the station. Our compass heading was about 35°, so we swung a bit to the east until the Azimuth Indicator pointed to 0°, or straight up from the nose of the little airplane on the dial. You do this when you want to "home" on a particular range station. If you don't want to head exactly for that station, you have to do a bit of figuring, based on the indicated heading.

Switching back from ADF to REC for an identification signal from the Baltimore range, we quickly heard *da-dit-dit-dit, dit-da, dit-da-dit-dit* or B-A-L in Morse Code coming in over the speaker, and that was it.

Obviously, this is a big improvement over the simple radio direction finder with hand-rotatable loop for adjustment to the fade-out or "null" position, and which cannot get away from that 180° ambiguity.

▶ **Omnimatic Check.** We then tried it with the Omnimatic. This is designed to provide an automatic bearing indication based on VHF Omni-Directional Ranges, or VOR. According to standard VOR procedure, you tune in a VOR station and, after getting a signal loud and clear, gradually alter your course until the cross-pointer indicator needles are centered; a "To-From" indicator takes care of ambiguity.

With the Omnimatic all you do is tune in the desired station and a scope indicator gives the exact compass course to that station, regardless of the heading of the airplane. No needles, no ambiguity!

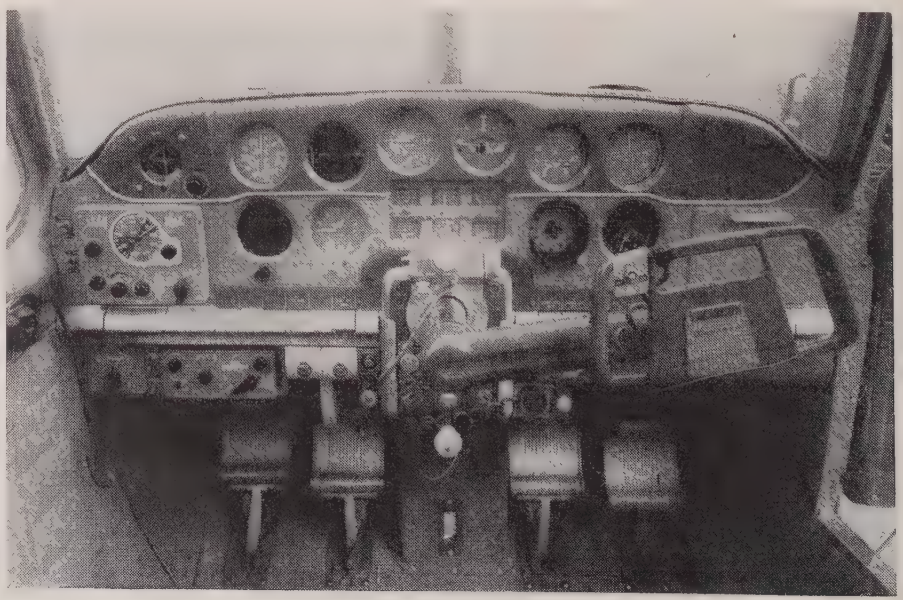
Our chart told us that Baltimore VOR was 115.8 mc. Tuning to this frequency, within a matter of seconds the Omniscope (three-inch cathode-ray oscilloscope tube, calibrated in degrees of azimuth) showed a green flicker at its center, which quickly jumped out to a full circle. The indicating pip was right on 44°, the heading for Baltimore omni. It was a bright sunny day, yet the rapidly oscillating green signal showed up quite clearly. Turning up the sound volume for a minute, we picked up B-A-L in code, and then turned the volume down again. With omni there's no point in putting up with the nuisance of an aural "beam."

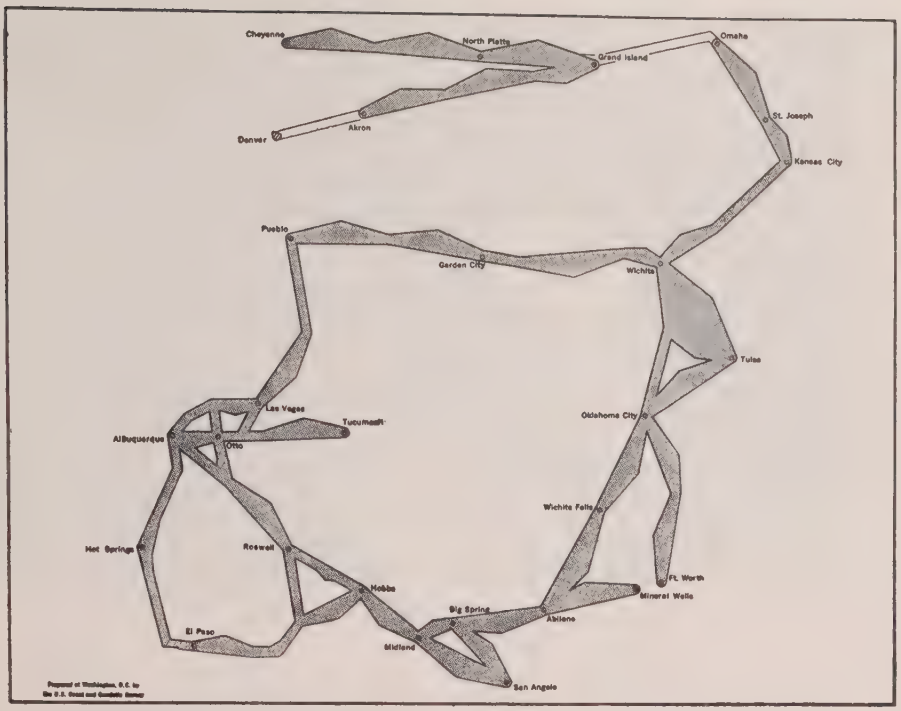
Flying over Friendship Airport, we were soon in the vicinity of Baltimore VOR. As we approached it, the green neon-like circle began to quiver, got very small, then much bigger and finally vanished for a second. Coming back to normal size and intensity, the pip was reversed to 224°, the reciprocal of 44°. This meant that with our compass still heading 44° we were flying away from Baltimore omni on the 224° "spoke."

If a VOR station becomes inoperative, if the tuning dial is moved accidentally, or if internal failure of the set occurs, no green circle shows up on the Omniscope, a "fail safe" feature of great value to pilots.

Some day I hope to take a longer flight and observe some VOR fixes, off-course navigation, etc. with the Omnimatic, but this trip was an eye-opener as to the utter simplicity of the system, and its value as a navigator for extensive X-C flying in big or little planes.

OMNIMATIC shown right center, *Orienter* dial to its right, control at lower left





VOR-CONTROLLER airways system consists of 41 omni stations and links 26 cities

New Omni Airway is Airline Flown

Continental Air Lines pilots begin operating first omni airway

During the last week of October, Continental Air Lines' pilots began operating the first CAA-approved VOR-controlled airways system. This system extends through six states and connects such important air-traffic terminals as Kansas City, Denver and Albuquerque. Omaha, Wichita, Tulsa, Oklahoma City, El Paso, Fort Worth and nearly a score of other cities are also linked into the system (*see map*).

▶ **VHF System.** The new VHF radio-range system covers about 4,380 miles of airways formed by the signals of 41 CAA VOR stations, out of 271 omniranges commissioned in different parts of the United States as of November 1.

This is the first time that a chain of these ranges has been designated by CAA as a controlled airway over which qualified pilots in properly equipped planes may operate under instrument flight rules (IFR). The new airway is in a section of the country relatively free of heavily congested air-traffic areas. This makes it possible to establish procedures which eventually will be useful throughout the air-transport industry.

Actually, however, this is not the first time a scheduled airline has used VHF omnirange. Since early spring American Airline pilots have consistently used VOR on the Nashville-Tulsa run. More recently Eastern has been checking with omni stations up and down the East Coast. United and other airlines also have been using VOR stations in various places. But all this has been on an unofficial basis.

Long before the airlines' use of omni, pilots of executive aircraft and of other privately flown planes were making extensive use of VOR stations as fast as these stations were commissioned.

▶ **Omni Stations.** By June 30, 1951, the CAA plans to have some 415 omni stations in operation, with an ultimate total of 466, plus 64 two-course VHF visual-aural ranges (VAR) which will be converted to omni.

Flying the VOR airways is relatively simple. Instead of listening continuously to dot-dash signals in his earphones as on the present LF four-course range, the pilot simply tunes into the omni station and flies so as to keep his cross-pointer needles centered. No static from approaching storms crash in the omni pilot's ears. The omni equipment also is used for low approach and letdown to airports under instrument conditions. Within two or three years, distance measuring equipment (DME) and the course-line computer (CLC) will enable a pilot to fly a straight line to any destination he wants, and not have to stick to established controlled airways. DME is ready, CLC in advanced test status.

THE WEEMS LINE includes many navigation aids and instruments which are standard equipment with U. S. Air Forces, major air lines and foreign governments. Many are navigation "musts" for pilot and student alike, especially the Weems Mark II Aircraft Plotter, the Dalton E-6B, or Mark VII Computer. A few of them are described below. Many others are available.

WEEMS MARK II PLOTTER: Scale fits sectional and world air charts. Used for plotting bearings, courses, measuring distances, constructing wind diagrams and angles. Only $2.00.

DALTON E-6B COMPUTER: Two sides. One for solving all vector problems—wind, true heading, ground speed. Other side graduated for computing speed-time-distance, fuel consumption, air speed and altitude corrections, as well as statute-nautical mile conversions. Only $10.00 complete.

DALTON MARK VII COMPUTER: Vector side "mocks-up" track-drift-true heading triangle, allows simple, easily oriented setting-up and solution of all wind problems. Computer side for speed-time-distance, fuel consumption, air speed and altitude corrections, and statute-nautical mile conversions, plus erasable air speed calibration chart and flight log. Only $5.00.

WEEMS PROPORTIONAL DIVIDERS: Given any two of three quantities (speed, time, distance), you can find the third in a few seconds. $24.00.

CROSS-COUNTRY COMPUTER: The well-known Mark VIII Computer with addition of flight log and securing straps. Solves all speed-time-distance problems. Only $4.00.

IMPORTANT NEW BOOKS: *Flying The Omnirange* by Zweng. Tells how to fly cross-country by means of new Omnirange facilities. $4.00.

Practical Air Navigation by Lyon. Invaluable to pilot and student alike. $2.50.

Instrument Flying by Weems & Zweng. $4.50.

Electronic Navigation by Orman. Explains workings of Radar, Loran, etc. $4.50.

Government Charts and Publications: A complete line.

WEEMS AIR NAVIGATION SCHOOL: Established 1927. Resident and Correspondence Courses. Send for details. Enrollment approved under G. I. Bill.

"See Your Aviation Supply Dealer"

OR, WRITE DIRECT FOR FREE CATALOG

Address Department 6
Weems System of Navigation
Annapolis, Maryland

AIR WSN WEEMS SEA SYSTEM OF NAVIGATION
ANNAPOLIS, MARYLAND

Grimes Navigator Aids Pilots on their X-C's

By Bob Blatt

The Grimes "Navigator" is a simple mileage indicator which provides an easy method of aircraft navigation. It consists of a spring-wound clock mechanism in a readily installed standard instrument case. The dial has a pointer which shows "Miles Flown." An insert scale shows "Groundspeed" in miles per hour—adjustable from 65 to 240 mph.

▶ **VF Aid.** It is a new and really sensational aid to contact flying. It tells at a glance where you are at any time and, without the need for calculation, it tells you your groundspeed. It quickly notes a change in wind velocity when you do not hit your check points on schedule, and it tells you when you are off course. It aids in navigating around local storms and, when you approach an airport, it tells you exactly how far away you are.

The "Navigator" is used in the following manner:

(1) Plot your course. "Navigation Tape" is a big help.

(2) Take off and reach your desired altitude on course.

(3) Set the "Navigator" groundspeed scale at estimated mph.

(4) At some nearby on-course check point on map set the "Miles Flown" pointer to correspond with the mileage from starting point or the map tape reading at such point.

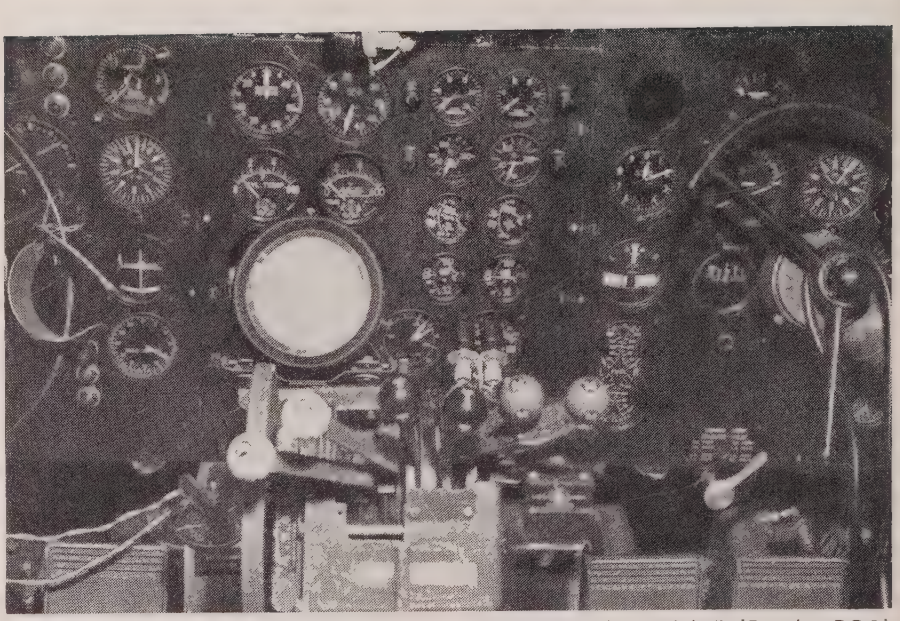
(5) Establish heading to maintain course.

(6) At the next major check point note the "Miles Flown" pointer reading and map tape or elapsed mileage reading. To compensate for tailwind or headwind, it may be necessary to slightly adjust the groundspeed scale, thus synchronizing the pointer and map tape or elapsed mileage readings.

(7) From then on merely maintain heading and note major check points by reading "Miles Flown" on map tape, or elapsed mileage.

▶ **Navigator Flight.** A short time ago I used my "Navigator" on a flight from Teterboro, N. J. to Lake Susquehanna Airport at Blairstown, N. J. where I took my plane to have a recovery job done on the wings. I set the "Groundspeed" at 100 mph since I estimated a tailwind of about 5 mph with my 95-mph Taylorcraft. My first check point was the Passaic River—about 2½ miles from the airport. At the Caldwell-Wright Airport —11½ miles from take-off, I checked again and found that my estimate of 100 mph was just about right. From then on, all I did was to maintain heading and, at the 50-mile "Miles Flown" point, there was the Lake Susquehanna Airport-right on the nose. Nothing could have been simpler or more reassuring.

The Grimes Company has just made available a new version of the "Navigator" which will have a speed range from 130 to 480 mph, doubling the capacity of the original model.



RADAR scope installation in cockpit of AA Engineering Flagship "Alpha" (Douglas DC-3)

Tester for VHF Receiver

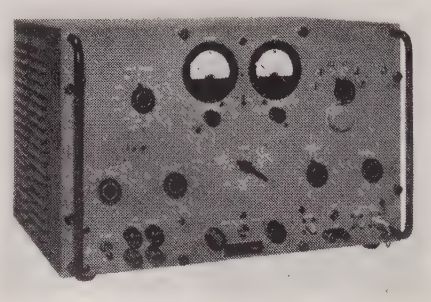
The Aircraft Radio Corporation, Boonton, N. J., has introduced a signal generator for complete testing of VHF airborne omnirange and localizer receivers in aircraft or on the bench.

The unit (ARC Type H-14) has a frequency range of 108-118 megacycles, and can be used for all necessary quantitative bench tests. It can also be used for checking out aircraft on the ramp.

It provides facilities for testing 24 omni courses, plus left-center-right checks on both amplitude and phase localizers for ILS approaches. RF output for ramp checks is one volt into a 52-ohm line and for bench checks, 0-10,000 microvolts.

ARC's H-14 generator is equipped for To-From indicator and Flag-Alarm testing. Provision for external voice or other modulation is also included. AF output is available for bench maintenance and trouble shooting.

The unit is priced at $885.00.



ARC's H-14 Signal Generator for VHF testing

Spotting Bad Weather by Airborne Radar

(*Continued from page 57*)

may have to wait for certain military developments.

▶ **Operation Evaluation.** American Airlines, under contract with Navy BuAer and BuShips, equipped a DC-3 (Alpha), and Convairliner (Gamma) and three DC-4 aircraft with airborne radar. The objective was the operational evaluation of airborne radar from the viewpoint of a transport-aircraft operator. As the tests continued the radar was modified to keep pace with operational requirements. As a result, the radar that came out of the aircraft at the end of the Navy Contract only remotely resembled the General Electric AN/APS-10 that was installed initially.

An example of such modification was the development of antenna which would switch from horizontal to circular polarization. This permitted the pilot to eliminate the echo resulting from precipitation and determine whether or not it was safe to fly through the echo.

Another modification was roll stabilizing the antenna by attaching it to a platform and using components of the Sperry A-12 Gyropilot.

Airborne, shipborne and shore-based radar is now in limited use by the Armed Forces, the CAA, the Weather Bureau and many marine services for detecting areas of rainfall. We may expect to see it come into general use for detecting the location of fog banks, the height of cloud layers, and many other things of interest to meteorologists. In fact, electronics may be the one thing that eventually will make the forecasting of weather an exact science by removing many of the variables in the equation. (From ION-RTCA-RTCM paper).

SKYWAYS INDEX-1950

A ready reference indexed by aviation subject matter

ACCIDENTS—CAUSES
Brain Leakage. P. 50. August.
But Sure. P. 56. March.
Careless Pedestrians. P. 50. January.
Crosswind Technique. P. 50. December.
Deaf, Dumb and Blind. P. 50. January.
Don't Lose Your Balance. P. 64. June.
Downwind Turn. P. 50. October.
Emergency Reactions. P. 46. November.
Forced Landing. P. 56. March.
Glide Speed. P. 58. April.
Homemade Repairs. P. 50. October.
Instrument Flight Not Blind. P. 39. February.
Let's Look at the Record. P. 56. September.
Maintenance Checks. P. 50. January
Mouse Wrecks Airplane. P. 36. April.
M. T. Head. P. 40. July.
Night Emergencies. P. 63. February.
No Good Unless Used. P. 34. January.
Pass the Bailing Wire. P. 26. July.
Patent Applied For. P. 37. June.
Pyromania. P. 50. December.
Shout it Again. P. 32. November.
Snow Will Fool You. P. 34. December.
Tab Crash. P. 34. January.
The Wreckord. P. 63. February.
Too Late. P. 40. July.
Top Billing. P. 33. October.
Tricycle Take-Off Technique. P. 35. March.
Use Best Tank. P. 56. March.
Your Responsibility. P. 63. February.

ACCIDENTS—PREVENTION
Avoid Those Wires. P. 32. November.
Be Weather Conscious. P. 58. April.
Brake Technique. P. 40. July.
Get Down or Get Out. P. 46. November.
Grim Maintenance. P. 64. May.
How's Your S.O.P., by Gilbert Close. P. 24. January.
Know Your Lights. P. 56. September.
Runways Shrink. P. 33. September.
Taxiology. P. 36. May.
Types of Weather to Avoid. P. 64. May.
Winter Safety Hints. P. 34. December.

ACCIDENTS—STATISTICS
Let's Look at the Record. P. 56. Sept.
The Wreckord. P. 63. February.

AEROBATICS
Clipped-Wing Clipper. Photo. P. 27. April.
Slow Roll It, by Sammy Mason. P. 20. September.
The Acrojets, by Al Leach. P. 22. August.

AERO-MEDICINE
Air Sickness. P. 32. August.
High-Speed Reaction. P. 51. October.

AIR DEFENSE
Air Defense and Civil Flying. P. 57. December.
Air Report on the Far East, by Martin Caidin. P. 10. September.
Combat . . . 8 Miles Up, by Col. N. F. Silsbee. P. 14. February.

AIR POWER
Air Report on the Far East, by Martin Caidin. P. 10. September.

AIR RACES
All-American Air Maneuver winners. Photo. P. 10 April.

AIR RECORDS
Loop Record. Photo. P. 8. July.
So You Want to Break a Record, by Capt. Norman Marsh. P. 22. April.
West-East: Charles Soderstrom. Photo. P. 30. October.

AIR SHOWS
The Acrojets, by Al Leach. P. 22. August.

AIR TRANSPORT
Air Transports' Next Step, by Col. N. F. Silsbee. P. 24. June.
Operation Cattle Lift, by Frank J. Taylor. P. 26. October.
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14 January.

AIR TRANSPORT—MILITARY
Life Line to Everywhere, by J. Fred Henry. P. 26. May.
Packet Passage, by A. S. Burchard. P. 20. October.

AIRCRAFT DESIGN
Let's Quit Griping, by Mike Jense. P. 12. August.
Attn: Plane Builders, by David Anderton. P. 32. January.
Pack Carriers for Cargo, by Ray Cantwell. P. 32. December.

AIRCRAFT INDUSTRY
Aircraft Production Program. Chart. P. 44. December.
Aircraft Sold. Chart. P. 48. October.
Let's Quit Griping, by Mike Jense. P. 12. August.
Production Unlimited. P. 10. November.
Selling to the Air Force, by Col. N. F. Silsbee. P. 17. December.

AIRCRAFT SERVICE
Airport With Profit, by Dick Brite. P. 16. November.
Handy Tie-Down. P. 40. December.
Let's Quit Griping, by Mike Jense. P. 12. August.
Service Brings $$. P. 20. November.

AIRLINES—MILITARY
Life Line to Everywhere, by J. Fred Henry. P. 26. May.

AIRLINES—NON-SCHEDULED
Operation Cattle Lift, by Frank J. Taylor. P. 26. October.

AIRLINES—SCHEDULED
Air Transports' Next Step, by Col. N. F. Silsbee. P. 24. June.
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14. January.

AIRPLANES—AERONCA
Champion. Photo. P. 41. February.
Champion. Photo. P. 48. August.
Model 7EC. Photo P. 10. May.
Sedan. Photo. P. 48. August.

AIRPLANES—AERO DESIGN & ENGINEERING
Aero Commander. Photo. P. 46. December.

AIRPLANES—ARMSTRONG WHITWORTH APOLLO
Apollo. Photo. P. 47. February.

AIRPLANES—AVION IBERAVIA
Iberavia. Photo. P. 42. November.

AIRPLANES—AVRO LINCOLN
Lincoln. Photo. P. 26. April.

AIRPLANES—AVRO 707
Flying Triangle. Photo. P. 55. January.

AIRPLANES—AVRO CANADA C-102
C-102. Photo. P. 40. September.
Jetliner. Photo. P. 50. February.

AIRPLANES—AVRO CANADA CF-100
CF-100. Photo. P. 30. March.

AIRPLANES—BEECH BONANZA
Beechcraft Bonanza. Photo. P. 40. February.
Beechcrafts for Brazil. Photo. P. 10. March.
California Commuter. P. 24. September.
Pilot's Report: New Bonanza, by Don Downie. P. 18. May.

AIRPLANES—TWIN-BONANZA
Announcing Twin-Bonanza. P. 47. January.
Flying Prototype. Photo. P. 29. December.

AIRPLANES—BEECH TWIN-QUAD
Attn.: Plane Builders, by D. Anderton. P. 32. January.

AIRPLANES—BEECH YT-34
YT-34 in Service. P. 36. October.

AIRPLANES—BELL X-1
X-1. Photo. P. 30. July.

AIRPLANES—BELLANCA CRUISEMASTER
Pilot's Report: Bellanca Cruisemaster, by L. M. Horton. P. 16. March.

AIRPLANES—BLACKBURN & GENERAL, LTD.
Gal. 60. Photo. P. 30. October.
YA-5. Anti-Sub Striker. Photo. P. 63. May.
YB-1. Turbo-Prop. Photo. P. 31. November.

AIRPLANES—BOEING B-47
B-47. Photo. P. 30. July.

AIRPLANES—BOEING B-50
B-50. Photo. P. 30. July.

AIRPLANES—BOEING YC-97
YC-97. Photo. P. 30. July.

AIRPLANES—BRADLEY SPECIAL
Bradley Special. Photo. P. 30. March.

AIRPLANES—BRISTOL BRABAZON
Brabazon 1. Photo. P. 54. January.

AIRPLANES—CESSNA 170
Cessna 170. P. 28. June.
New Cessna 170. Cover Kodachrome. August.

AIRPLANES—CESSNA 195
Cessna 195. Cover Kodachrome. January.
Cessna 195 fleet. Photo. P. 34. November.
Pilot's Report: Cessna 195, by Bob Arentz. P. 16. January.

AIRPLANES—CESSNA 305
Cessna 305 for Army. Photo. P. 40. August.

AIRPLANES—CHANCE VOUGHT F4U
F4U. Photo. P. 30. November.
F4U-5N. Photo. P. 26. August.

AIRPLANES—CHANCE VOUGHT F6U
F6U. Photo. P. 26. August.
XF6U. Photo. P. 31. February.

AIRPLANES—CHANCE VOUGHT F7U
F7U. Photo. P. 26. August.

AIRPLANES—CHASE AVITRUC
Avitruc XC-123. P. 22. January.
XC-123. Photo. P. 31. July.

AIRPLANES—CHASE YC-122
YC-122. Photo. P. 30. July.

AIRPLANES—COLONIAL SKIMMER
Skimmer amphibian. Photo. P. 10. January.
Skimmer. Photo. P. 29. November.

AIRPLANES—CONSOLIDATED B-36
B-36. Photo. P. 8. June.
B-36. Photo. P. 31. July.
B-36. Photo. P. 8. September.
B-36. Photo. P. 29. November.
B-36. Lay-out. Photo. P. 52. May.
RB-36. Photo. P. 42. December.

AIRPLANES—CONSOLIDATED CONVAIRLINER
Convair instrument panel. Photo. P. 40. May.

AIRPLANES—CONSOLIDATED C-99
C-99. Photo. P. 30. February.
C-99. Photo. P. 31. July.

AIRPLANES—CONSOLIDATED T-29
T-29. Photo. P. 31. July.

AIRPLANES—CONSOLIDATED XF-92
Jet Interceptor, by Don Downie. P. 14. March.
XF-92A. Photo. P. 31. July.
XF-92. Cover Kodachrome. March.

AIRPLANES—CONSOLIDATED XP5Y-1
XP5Y-1. Photo. P. 26. August.
XP5Y-1. Photo. P. 8. November.

AIRPLANES—COWARD WEE BEE
Pilot's Report: Wee Bee, by Bill Chana. P. 14. November.

AIRPLANES—CZECH SKAUT
Skaut M 2. Photo. P. 50. January.

AIRPLANES—DE HAVILLAND BEAVER
Pilot's Report: D. H. Beaver, by Don Downie. P. 20. June.
N. Y. Daily News Beaver. Photo. P. 52. October.

AIRPLANES—DE HAVILLAND CHIPMUNK
D. H. Chipmunk. Photo. P. 31. October.

AIRPLANES—DE HAVILLAND DOVE
D. H. Dove. Photo. P. 34. September.
Flying the Dove. P. 36. December.

AIRPLANES—DE HAVILLAND VAMPIRE
D. H. Vampire Night Fighter. Photo. P. 48. January.
Vampire. Photo. P. 31. March.

AIRPLANES—DOUGLAS A2D
A2D. Cover Kodachrome. December.
New Navy A2D. P. 23. September.
Turbo-Prop Skyshark, by Gilbert Close. P. 10. October.

AIRPLANES—DOUGLAS AD-3W
AD-3W. Photo. P. 27. August.
AD-3W. Photo. P. 8. January.

AIRPLANES—DOUGLAS C-124
C-124. Photo. P. 30. March.
C-124. Photo. P. 32. July.
USAF Cargo Carrier. P. 28. February.

AIRPLANES—DOUGLAS DC-3
Godfrey's Executive Transport, by D. N. Fairbairn. P. 11. December.
Turbo-Prop DC-3, by Wm. Green. P. 18. August.

AIRPLANES—DOUGLAS DC-6
Liftmaster. Photo. P. 55. January.

AIRPLANES—DOUGLAS D-558
Mission: D-558, by Gilbert Close. P. 10. August.
Skyrocket. Photo. P. 46. February.
Skyrocket. Cover Kodachrome. September.

AIRPLANES—DOUGLAS F3D
F3D. Photo. P. 27. August.
Skyknight Rider, by Russell Thaw. P. 12. September.

AIRPLANES—DOUGLAS SBD
SBD. Photo. P. 29. December.

AIRPLANES—ELDRED
Prototype amphibian. Photo. P. 10. January.

AIRPLANES—EKLUND TE-1
Finnish TE-1. Photo. P. 30. September.

AIRPLANES—EMIGH TROJAN
Fly the Trojan, by Mardo Crane. P. 20. January.

AIRPLANES—ENGLISH ELECTRIC CANBERRA
Canberra. Photo. P. 31. February.
RAF Canberra. Photo. P. 42. August.

AIRPLANES—ERCOUPE
Ercoupe. Photo. P. 10. May.
Pilot's Report: New Ercoupe, by A. H. Hasbrook. P. 14. September.

AIRPLANES—FAIRCHILD F-24
Flight to the Caribbean, by Marc Henrion. P. 34. June.

AIRPLANES—FAIRCHILD PACKET
C-119. Photo. P. 32. July.
New Packet. Photo. P. 42. March.
Packet Passage, by A. S. Burchard. P. 20. October.

AIRPLANES—FAIRCHILD R4Q. Photo. P. 27. August.

AIRPLANES—FAIRCHILD T-31
Trainer. Photo. P. 31. November.

AIRPLANES—FAIRCHILD XC-120
Pack Carriers for Cargo, by Ray Cantwell. P. 32. December.
Pack Plane. P. 19. October.

AIRPLANES—FOUGA CYCLONE (Sylphe)
Cyclone. Photo. P. 30. February.
Cyclone, Jet Lightplane, by L. M. Horton. P. 28. April.

AIRPLANES—FULTON AIRPHIBIAN
Airphibian. Cover Kodachrome. October.
Pilot's Report: Airphibian, by L. M. Horton. P. 14. August.

AIRPLANES—GLOSTER METEOR
Meteor 8. Photo. P. 37. November.
Meteor NF-11. Photo. P. 31. October.
NF-11. Photo. P. 28. December.

AIRPLANES—GOODYEAR GA-2
GA-2 Take-Off. Photo. P. 8. August.

AIRPLANES—GRUMMAN AF-2W
AF-2W. Photo. P. 28. August.

AIRPLANES—GRUMMAN F8F
F8F. Photo. P. 27. April.

AIRPLANES—GRUMMAN F9F
F9F. Photo. P. 28. August.

AIRPLANES—GRUMMAN UF-1
UF-1. Photo. P. 28. August.
AIRPLANES—KARHU 48
Tavi. Photo. P. 29. November.
AIRPLANES—LANIER PARAPLANE
Paraplane. Photo. P. 55. January.
AIRPLANES—LOCKHEED F-80
F-80's. Photo. P. 27. April.
The Acrojets, by Al Leach. P. 22. August.
AIRPLANES—LOCKHEED F-90
F-90. Cover Kodachrome. April.
Strike Fighter, by Tony LeVier. P. 14. May.
XF-90. Photo. P. 32. July.
AIRPLANES—LOCKHEED F-94
F-94. Photo. P. 32. July.
AIRPLANES—LOCKHEED P2V-4
P2V-4. Photo. P. 8. May.
P2V-4. Photo. P. 28. August.
AIRPLANES—PO-1W
Navy's PO-1W. Photo. P. 8. April.
PO-1W. Photo. P. 29. August.
AIRPLANES—LOCKHEED T-33
T-33. Photo. P. 32. July.
AIRPLANES—LOCKHEED TO-2
TO-2. Photo. P. 29. August.
AIRPLANES—MACCHI MB 320
Italian MB 320. Photo. P. 10. March.
MB 320. Photo. P. 46. May.
AIRPLANES—MARTIN AM-1
AM-1. Photo. P. 29. August.
AIRPLANES—MARTIN P4M-1
P4M-1. Photo. P. 29. August.
AIRPLANES—MARTIN P5M
P5M. Photo. P. 30. August.
AIRPLANES—MARTIN XB-51
XB-51: Jet Bomber. P. 18. January.
XB-51. Photo. P. 8. February.
XB-51. Photo. P. 33. July.
AIRPLANES—McDONNELL F2H-2
F2H-2. Photo. P. 30. August.
AIRPLANES—McDONNELL FH-1
FH-1. Photo. P. 30. August.
AIRPLANES—McDONNELL XF-88
XF-88. Photo. P. 33. July.
AIRPLANES—NORTH AMERICAN AJ-1
AJ-1. Photo. P. 30. August.
AIRPLANES—NORTH AMERICAN B-45
Bomb Test. Photo. P. 8. November.
B-45. Photo. P. 33. July.
B-45. Photo. P. 37. December.
RB-45C. Photo. P. 30. September.
AIRPLANES—NORTH AMERICAN F-51
Mustang. Photo. P. 8. October.
AIRPLANES—NORTH AMERICAN F-86
Canadian-built Sabre. Photo. P. 48. December.
F-86. Photo. P. 30. November.
F-86. Photo. P. 34. July.
Sabre. Cover Kodachrome. May.
Sky-High Sabre Dance, by George Welch. P. 14. April.
YF-86D. Photo. P. 58. May.
AIRPLANES—NORTH AMERICAN F-95
F-95. Photo. P. 34. July.
AIRPLANES—NORTH AMERICAN T-6
T-6 Trainer. Photo. P. 31. September.
AIRPLANES—NORTH AMERICAN T-28
Pilot's Report: USAF T-28, by Don Downie. P. 14. December.
T-28. Photo. P. 33. July.
AIRPLANES—NORTH AMERICAN YF-93A
New Jet YF-93A. P. 17. April.
YF-93A. Photo. P. 58. May.
YF-93A. Photo. P. 34. July.
AIRPLANES—NORTHROP C-125
C-125. Photo. P. 26. April
C-125. Photo. P. 35. July.
Raider. Photo. P. 56. February.
AIRPLANES—NORTHROP F-89
Night Watch of the Air Force, by Fred Bretcher. P. 14. June.
F-89. Photo. P. 34. July.
AIRPLANES—NORTHROP X-4
X-4. Photo. P. 35. July.
AIRPLANES—PIPER CUB
Clipped Wing Piper. Photo. P. 27. April.
Pilot's Report: Super Cub, by H. L. May. P. 14. October.
Piper Super Cub. Photo. P. 26. April.
AIRPLANES—PIPER PACER
Flight Home. Photo. P. 28. December.
Pacer Panel. Photo. P. 10. April.
Pilot's Report: Pacer, by Gloria Heath. P. 16. February.
Piper Pacer Ambulance. Photo. P. 28. December.
AIRPLANES—REPUBLIC F-84
Destroyers Up, by A. S. Burchard. P. 18. July.
F-84. Photo. P. 35. July.
F-84E. Photo. P. 8. January.
Range. Photo. P. 25. July.
YF-96A (now F-84). Photo. P. 36. July.
AIRPLANES—REPUBLIC XF-91
XF-91. Cover Kodachrome. June.
XF-91. Photo. P. 50. March.
XF-91. Photo. P. 35. July.
AIRPLANES—REPUBLIC YF-96A
See F-84.
AIRPLANES—RYAN NAVION
Flights of a Farmer. P. 28. May.
Navion. Photo. P. 39. January.
Navion. Cover Kodachrome. July.
Navion Deluxe 205. Photo. P. 56. May.
Pilot's Report: New Navion 260, by Don Downie. P. 14. July.
Sky Cops, by Steve Allen. P. 16. May.
Super Navion. Photo. P. 39. December.
AIRPLANES—SHORT S.B. 3
Dumbo. Photo. P. 50. November.
AIRPLANES—SKANDINAVISK AERO
KZ VIII. Photo. P. 31. November.
AIRPLANES—SWEDISH SAAB
Saab 29. Photo. P. 30. February.
AIRPLANES—WESTLAND WYVERN
Wyvern. Photo. P. 50. November.
AIRPLANE HANDLING
Pilots, Brush Up Those Landings, by Gloria Heath. P. 30. June.
Trim that Torque, by A. H. Hasbrook. P. 28. October.
AIRPLANE INSPECTION
How's Your S.O.P., by Gilbert Close. P. 24. January.
Overload Damage, by Gilbert Close. P. 28. March.
Tie-Down Traces, by Gilbert Close. P. 18. September.
AIRPLANE STUNTING
Clipped Wing Piper. Photo. P. 27. April.
Slow Roll It, by Sammy Mason. P. 20. September.
The Acrojets, by Al Leach. P. 22. August.
AIRPLANE USES
Air Photos Pay Off, by H. J. Burrows. P. 30. May.
California Commuter. P. 24. September.
Dawn to Dust, by M. Riley P. 26. March.
Flights of a Farmer. P. 28. May.
I'm a Rainmaker, by Bob Symons. P. 16. June.
News Photo Below, by Dee Allen. P. 18. December.
Pen-Air. P. 28. September.
Sky Cops, by Steve Allen. P. 16. May.
AIRPORTS
Airport "Extra", by H. Helfer. P. 36. February.
Airport With Profit, by Dick Brite. P. 16. November.
Dawn Patrol. Photo. P. 8. July.
Runway Markings Pilot Aid, by Ralph Brown. P. 64. August.
ALTIMETER
Altimeter Facts. P. 43. April.
Use Your Altimeter Setting, by Bob Mudge. P. 32. February.
ARCTIC
Jets on the Gages, by Bob Arentz. P. 24. April.
Operation Zero-Zero, by Bob Arentz. P. 18. November.
ARMAMENT
Daniel Boone was a Piker, by Lt. Don Stuck. P. 16. October.
ATMOSPHERE
Combat—8 Miles Up, by Col. N. F. Silsbee. P. 14. February.
500 Miles Up, by H. E. Roberts. P. 32. March.
AUTRY, GENE
Flying Cowboy, by Pat Murphy. P. 22. December.
BAIL-OUT
Emergency Escape from Jets. Photo. P. 8. March.
High-Speed Bail-Out, by Lt. Cmdr. M. Cagle. P. 22. November.
BLIND FLYING
Operation Zero-Zero, by Bob Arentz. P. 18. November.
Over the Overcast, by Bob Arentz. P. 19. March.
CAA
The Wreckord. P. 63. February.
CAOA
CAOA Report. P. 40. January; P. 44. February; P. 39. March; P. 40. April, May, June; P. 28. July; P. 34. August, September, October, November; P. 36. December.
CAP
CAP News. P. 38. March; P. 42. April, May, June.
CLOUDS
500 Miles Up, by H. E. Roberts. P. 32. March.
COCKPITS
Hell in the Cockpit, by Lt. H. Searls. P. 24. March.
COLD WEATHER FLYING
B$ for Winter Flying, by Tex Sallee. P. 30. January.
Watch Out for Ice, by W. A. Dixon. P. 26. December.
CROP DUSTING
Dawn to Dust, by M. Riley. P. 26. March.
Dusting School Planes. Photo. P. 30. September.
DILBERT
Dilbert, by S. H. Warner & Robt. Osborn. P. 34. January; P. 38. February; P. 34. March; P. 36. April, May, June; P. 26. July; P. 32. August, September, October, November; P. 36. December.
EDITORIALS
Too Little Too Late, by J. Fred Henry. P. 64 January.
ELECTRICAL SYSTEM
Circuit Maintenance, by W. Nye. P. 26. November.
Static Chaser, by Jerry Leichter. P. 26. February.
ENGINES
Allison 501 (T-38). Photo. P. 31. November.
Avro Orenda. Photo. P. 8. April.
Compound for P2V. Photo. P. 8. September.
Jet for Lightplanes, by J. Lemelson. P. 22. October.
Jet Pod: B-36. Photo. P. 9. October.
New Lycoming. Photo. P. 58. March.
Pratt & Whitney J-48 Turbo-Wasp. Photo. P. 8. May.
Pratt & Whitney J-48. Photo. P. 52. September.
Pratt & Whitney T-34. Photo. P. 8. December.
EQUIPMENT
Flying Loudspeaker System. P. 52. November.
Make Your Own Shoulder Harness, by Frank Andrews. P. 25. February.
Personal Plane Auto-Pilot. P. 61. November.
Zero Reader for Executive Planes, by R. D. Brown. P. 61. October.
EXECUTIVE AIRCRAFT
Company Navion. Photo. P. 34. October.
Cost of Comfort, by G. J. Mills. P. 12. July.
D. H. Dove. Photo. P. 34. September.
Dollars and Sense in Exec Flying, by Col. N. F. Silsbee. P. 20. March.
Executive DC-3. Photo. P. 40. May.
Flying Cowboy, by Pat Murphy. P. 22. December.
Flying the Dove. P. 36. December.
Godfrey's Executive Transport, by D. N. Fairbairn. P. 10. December.
Pen-Air. P. 28. September.
Progress. P. 45. September.
FLIGHT EXAMINATION
Flight Exam, by L. M. Horton. P. 20. July.
Whip Stall Save, by A. J. Nogard. P. 19. February.
FLIGHT INSTRUCTOR
No Brakes on my Side, by V. A. Prevette. P. 30. December.
FLIGHTS
Airway to Acapulco, by Don Downie. P. 24. November.
Alaska to Norway, by Col. Bernt Balchen. P. 22. May.
Canyon Caper, by A. J. Kounalis. P. 17. September.
Dawn Patrol. Photo. P. 8. July.
Flights of a Farmer. P. 28. May.
Flight to the Caribbean, by Marc Henrion. P. 34. June.
Over the Overcast, by Bob Arentz, P. 19. March.
Read Me the Road Map, by Rudy Libra. P. 12. October.
So You Want to Break a Record, by Capt. Norman Marsh. P. 22. April.
Whip-Stall Save, by A. J. Nogard. P. 19. February.
FLYING FARMERS
Flights of a Farmer. P. 28. May.
Range Rider Galloway. Photo. P. 31. October.
FOREIGN PLANES
Armstrong Whitworth Apollo. Photo. P. 47. February.
Avion Iberavia. Photo. P. 42. November.
Avro Lincoln. Photo. P. 26. April.
Avro 707. Photo. P. 55. January.
Avro Canada C-102. Photo. P. 50. February.
Avro Canada CF-100. Photo. P. 30. March.
Blackburn General Gal. 60. Photo. P. 30. October.
Blackburn General YA 5. Photo. P. 63. May.
Bristol Brabazon. Photo. P. 54. January.
Czeck Skaut. Photo. P. 50. January.
De Havilland Beaver: Pilot's Report, by Don Downie. P. 20. June.
De Havilland Beaver: N. Y. Daily News. Photo. P. 52. October.
De Havilland Chipmunk. Photo. P. 31. October.
De Havilland Dove. Photo. P. 34. September.
De Havilland Dove. P. 36. December.
De Havilland Vampire. Photo. P. 48. January.
De Havilland Vampire. Photo. P. 31. March.
Eklund TE-1. Photo. P. 30. September.
English Electric Canberra. Photo. P. 31. February.
English Electric Canberra. Photo. P. 42. August.
Fouga Cyclone (Sylphe). Photo. P. 30. February.
Fouga Cyclone: Jet Lightplane, by L. M. Horton. P. 28. April.
Gloster NF-11. Photo. P. 31. October.
Gloster NF-11. Photo. P. 28. December.
Macchi MB320. Photo. P. 10. March.
Macchi MB320. Photo. P. 46. May.
Short S.B. 3. Photo. P. 50. November.
Swedish Saab. Photo. P. 30. February.
Westland Wyvern. Photo. P. 50. November.
FUEL
Aviation Fuel. P. 38. May.
GADGETS
Make Your Own Shoulder Harness, by Frank Andrews. P. 25. February.
Portable Scooter. P. 64. March.
Scooter—O.D. Lutes. Photo. P. 24. July.
Use Your Altimeter Setting, by Bob Mudge. P. 32. February.
GCA
Lightplane Mayday: GCA, by Jerry Leichter. P. 22. March.
Operation Zero-Zero, by Bob Arentz. P. 18. November.
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14. January.
GERMANY
F-80 at Furstenfeldbruck AFB. Photo. P. 27. April.
GUIDED MISSILES
Ryan Firebird. Photo. P. 55. January.
HANDLING
Pilots, Brush Up Those Landings, by Gloria Heath. P. 30. June.
Trim that Torque, by A. H. Hasbrook. P. 28. October.
HANGAR FLYING
Hangar Flying. P. 10. January, February, March, April, May, June; P. 8. July, August; P. 52. October.
HELICOPTERS
Bell E-47. Photo. P. 29. December.
Bell HTL-2. Photo. P. 31. August.
Bell 47D: N. Y. Police. Photo. P. 30. October.
Hiller 360. Photo. P. 9. December.
Hillercopter, by Don Downie. P. 22. February.
Hillercopter. Photo. P. 44. June.
Hoppicopter. Photo. P. 51. November.
Italian Helicopter. Photo. P. 25. July.
Kaman Explorer. Photo. P. 49. October.
McDonnell XHJD. Photo. P. 31. August.
Piasecki HRP-1. Photo. P. 31. August.
Piasecki XHJP. Photo. P. 31. August.
Piasecki HRP-2. Photo. P. 31. February.
Sikorsky H-19. Photo. P. 31. March.
Sikorsky HO3S. Photo. P. 31. February.
Sikorsky HO3S. Photo. P. 31. August.
Sikorsky: Flight Testing. P. 8. March.
INDEX
1949 Index. P. 60. January.
INSPECTION
Overload Damage, by Gilbert Close. P. 29. March.
How's Your S.O.P., by Gilbert Close. P. 24. January.
Tie-Down Traces, by Gilbert Close. P. 18. Sept.

INSTRUMENT FLYING
Fly IFR If . . . , by Andy Witmer. P. 35. February.
Hell in the Cockpit, by Lt. H. Searls. P. 24. March.
Jets on the Gages, by Bob Arentz. P. 24. April.
Let-Down by George, by D. N. Fairbairn. P. 26. January.
Over the Overcast, by Bob Arentz. P. 19. March.
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14. January.

INSTRUMENTS
Altimeter Facts. P. 43. April.
Angle of Attack, by V. A. Prevette. P. 34. May.
Engine Instruments. P. 38. April.
Know Your IAS, by J. W. Rocke. P. 26. September.
Zero Reader for Executive Planes, by R. D. Brown. P. 61. October.

ILS
Let-Down by George, by D. N. Fairbairn. P. 26. January.
Omni-ILS Demonstrated. P. 59. October.
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14. January.

JET
Avro Orenda. Photo. P. 8. April.
Fouga Cyclone. Photo. P. 30. February.
Jet Interceptor: XF-92, by Don Downie. P. 14. March.
Jets on the Gages, by Bob Arentz. P. 24. April.
U. S. Jet Air Force. Special Section. P. 29 to 35. July.

JET AIRPLANES
Acrojets, by Al Leach. P. 22. August.
Avro 707. Photo. P. 55. January.
Avro Canada C-102. Photo. P. 50. February.
Avro Canada C-102. Photo. P. 40. September.
Avro Canada CF-100. Photo. P. 30. March.
Boeing B-47. Photo. P. 30. July.
Chance Vought F6U. Photo. P. 31. February.
Chance Vought F6U. Photo. P. 26. August.
Chance Vought F7U. Photo. P. 26. August.
Consolidated XF-92, by Don Downie. P. 14. March.
Consolidated XF-92. Cover Kodachrome. March.
Consolidated XF-92A. Photo. P. 31. July.
De Havilland Vampire. Photo. P. 48. January.
De Havilland Vampire. Photo. P. 31. March.
Douglas F3D. Photo. P. 27. August.
Douglas F3D. Skyknight Rider, by Russell Thaw. P. 12. September.
English Electric Canberra. Photo. P. 31. February.
English Electric Canberra. Photo. P. 42. August.
Fouga Cyclone. Photo. P. 30. February.
Fouga Cyclone, Jet Lightplane, by L. M. Horton. P. 28. April.
Gloster NF-11. Photo. P. 31. October.
Grumman F9F. Photo. P. 28. August.
Lockheed F-80. Photo. P. 27. April.
Lockheed F-90. Cover Kodachrome. April.
Lockheed F-90: Strike Fighter, by Tony LeVier. P. 14. May.
Lockheed F-90. Photo. P. 32. July.
Lockheed F-94. Photo. P. 32. July.
Lockheed TO-2. Photo. P. 29. August.
Lockheed T-33. Photo. P. 32. July.
Martin XB-51. Jet Bomber. P. 18. January.
Martin XB-51. Photo. P. 8. February.
Martin XB-51. Photo. P. 33. July.
McDonnell F2H-2. Photo. P. 30. August.
McDonnell FH-1. Photo. P. 30. August.
McDonnell XF-88. Photo. P. 33. July.
North American B-45. Photo. P. 8. November.
North American B-45. Photo. P. 30. September.
North American B-45. Photo. P. 33. July
North American B-45. Photo. P. 37. December.
North American F-86. Cover Kodachrome. May.
North American F-86. Photo. P. 30. November.
North American F-86: Sky-High Sabre Dance, by George Welch. P. 14. April.
North American F-86. Photo. P. 34. July.
North American YF-86D. Photo. P. 58. May.
North American YF-93A. P. 17. April.
North American YF-93A. Photo. P. 58. May.
North Amercian YF-93A. Photo. P. 34. July.
Northrop F-89: Night Watch of the Air Force, by Fred Bretcher. P. 14. June.
Northrop F-89. Photo. P. 34. July.
Northrop X-4. Photo. P. 35. July.
Republic F-84E. Photo. P. 8. January.
Republic F-84. Photo. P. 35. July.
Republic XF-91. Photo. P. 50. March.
Republic XF-91. Cover Kodachrome. June.
Republic XF-91. Photo. P. 35. July.
Republic YF-96A. Photo. P. 36. July.
Swedish Saab 29. Photo. P. 30. February.

LANDING
Let-Down by George, by D. N. Fairbairn. P. 26. January.
Operation Zero-Zero, by Bob Arentz. P. 18. November.
Pilots, Brush Up Those Landings, by Gloria Heath. P. 30. June.
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14. January.
Something to Think About. P. 50. August.

LIGHTS
Mike Lights. P. 54. February.

MAINTENANCE
Airline Installs Omni Check Unit, by D. S. Little. P. 60. July.
Check and Double Check, by Gilbert Close. P. 17. July.
Circuit Maintenance, by W. L. Nye. P. 26. November.
Cleaning and Care of Aircraft Surfaces. P. 36. March.
How's Your S.O.P., by Gilbert Close. P. 24. January.
Know Your IAS, by J. W. Rocke. P. 26. September.
R for Winter Flying, by Tex Sallee. P. 30. January.
Service Notes: Piper Pacer. P. 38. June.
Static Chaser, by Jerry Leichter. P. 26. February.
Tie-Down Traces, by Gilbert Close. P. 18. September.
Windshields Call For Care. P. 40. February.

MANEUVERS
Destroyers Up, by A. S. Burchard. P. 18. July.
Thunder Over the Caribbean, by Sidney W. Dean, Jr. P. 32. May.

MARINE AVIATION
Marine Bees. Photo. P. 54. May.
Marine Corps Packet. Photo. P. 48. May.
U. S. Air Navy Special Section. P. 25. August.

MAY, GENE
May, Gene. Test Pilot. P. 46. February.

MIDGET RACERS
Cosmic Wind: Pilot's Report, by Fish Salmon. P. 18. April.

MILITARY
Aerial Triple-Threaters, by Joseph Stocker. P. 24. December.
Air Cadet. P. 24. October.
Air Report on the Far East, by Martin Caidin. P. 10. September.
Alaska to Norway—Non-Stop, by Col. Bernt Balchen. P. 22. May.
Chase Avitruc. P. 22. January.
Combat Crew, by R. T. Sacopi. P. 12. November.
Combat—8 Miles Up, by Col. N. F. Silsbee. P. 14. February.
Daniel Boone Was a Piker, by Lt. Don Stuck. P. 16. October.
Destroyers Up, by A. S. Burchard. P. 18. July.
Hell-Bent for Rescue, by Terry Kay. P. 20. April.
High-Speed Bail-Out, by Lt. Cmdr. M. Cagle. P. 22. November.
Jet Interceptor: XF-92, by Don Downie. P. 14. March.
Jets on the Gages, by Bob Arentz. P. 24. April.
Life Line to Everywhere, by J. Fred Henry. P. 26. May.
Mission: D-558, by Gilbert Close. P. 10. August.
New Jet Fighter for AF. P. 17. April.
Night Watch of the AF, by Fred Bretcher. P. 14. June.
Pack Carriers for Cargo, by Ray Cantwell. P. 32 December.
Packet Passage, by A. S. Burchard. P. 20. October.
Re-Birth of a Bomber. P. 20. December.
Scramble, by Capt. C. S. Powell. P. 20. August.
Selling to the Air Force, by Col. N. F. Silsbee. P. 17. December.
Sky-High Sabre Dance, by George Welch. P. 14. April.
Special Missions, USAFE, by M/Sgt. P. Moriarity. P. 26. June.
Strike Fighter: F-90, by Tony LeVier. P. 14. May.
Thunder Over the Caribbean, by Capt. S. Dean, Jr. P. 32. May.
USAF Cargo Carrier. P. 28. February.
U. S. Jet Air Force. Special Section. P. 29. July.
XB-51—Jet Bomber. P. 18. January.
YT-34 in Service. P. 36. October.

MILITARY AVIATION
Military Aviation. P. 8. January, February, March, April, May, June, September, October, November, December.

MOTION PICTURES
Chain Lightning. P. 20. February.

NAVAL AVIATION
Hell in the Cockpit, by Lt. H. Searls. P. 24. March.
New Carrier. Photo. P. 49. December.
New Navy A2D. P. 23. September.
Skyknight Rider, by Russell Thaw. P. 12. September.
Test-Pilot Training, by Lt. H. Searls. P. 32. April.
The Snorkel Sniper, by Stan Beltz. P. 10. July.
Turbo-Prop Skyshark, by Gilbert Close. P. 10. October.
U. S. Air Navy. Special Section. P. 25. August.

NAVICOM
Navigation-Communication Section, edited by Col. N. F. Silsbee. Pages 57 to 64. July, August, September, October, November, December.

NAVIGATION
Use Your Altimeter Setting, by Bob Mudge. P. 32. February.

NAVIGATION-RADIO
ACC Gives Pilots Demonstration. P. 64. September.
Air-Nav. ATC System, by Joseph Blatt. P. 59. September.
Flying Omnirange. P. 13. December.
Microwave Lighthouse, by Col. N. F. Silsbee. P. 30. April.
Navigation with Narco, by Col. N. F. Silsbee. P. 59. November.
Never Get Lost, by Ben Robin. P. 34. April.
Omni-ILS Demonstration. P. 60. September.
Pilot Answers Omni Questions, by Col. S. A. Mundell. P. 61. August.
Radio Aids For Business Flying, by Arthur Godfrey. P. 59. August.

OLD AIRPLANES
Last Flight. Photo. P. 38. October.
Prest Baby Pursuit. Photo. P. 38. July.
Remember These. P. 32. June.

PERSONAL AIRPLANES
Aerocar. Photo. P. 23. June.
Aeronca Champion. Photo. P. 48. August.
Aeronca Model 7EC. Photo. P. 10. May.
Aeronca Sedan. Photo. P. 48. August.
Alaparma 65. Photo. P. 23. June.
Auster Aristocrat. Photo. P. 30. March.
Avion Iberavia. Photo. P. 42. November.
Beech Bonanza. Photo. P. 10. March.
Beech Twin Beech. Photo. P. 10. March.
Beech Twin Bonanza. P. 47. January.
Beech Twin Bonanza. Photo. P. 29. December.
Bradley Imp. Photo. P. 19. June.
Bradley Special. P. 30. March.
Brazilian Trainer. Photo. P. 10. February.
California Commuter. P. 24. September.
Cessna 170. P. 28. June.
Cessna 170. Cover. August.
Cessna 195. Photo. P. 44. February.
Clipped Wing Piper. Photo. P. 27. April.
Colonial Skimmer. Photo. P. 10. January.
Colonial Skimmer. Photo. P. 29. November.
Culver PQ-14A. Photo. P. 31. September.
Czech Skaut. Photo. P. 50. January.
De Havilland Chipmunk. Photo. P. 31. October.
Eklund TE-1. Photo. P. 30. September.
Eldred ED-2. Drawing. P. 10. January.
Ercoupe. Photo. P. 10. May.
Fouga Cyclone. Photo. P. 30. February.
Fouga Cyclone, by L. M. Horton. P. 28. April.
Fulton Airphibian. Cover. October.
Goodyear GA-2. Photo. P. 8. August.
Italian MB320. Photo. P. 10. March.
Italian MB320. Photo. P. 46. May.
Karhu 48. Photo. P. 29. November.
Kysor 1. Photos. P. 25. July.
Lanier Paraplane. Photo. P. 55. January.
Pilot's Report. . . . Beech Bonanza, by Don Downie. P. 18. May.
Pilot's Report. . . . Bellanca Cruisemaster, by L. M. Horton. P. 16. March.
Pilot's Report. . . . Cosmic Wind, by Fish Salmon. P. 18. April.
Pilot's Report. . . . D. H. Beaver, by Don Downie. P. 20. June.
Pilot's Report. . . . Emigh Trojan, by Mardo Crane. P. 20. January.
Pilot's Report. . . . Ercoupe, by A. H. Hasbrook. P. 14. September.
Pilot's Report. . . . Fulton Airphibian, by L. M. Horton. P. 14. August.
Pilot's Report. . . . Nelson Hummingbird, by L. M. Horton. P. 28. January.
Pilot's Report. . . . Piper Pacer, by Gloria Heath. P. 16. February.
Pilot's Report. . . . Piper Super Cub, by H. L. May. P. 14. October.
Pilot's Report. . . . Ryan Navion 260, by Don Downie. P. 14. July.
Pilot's Report. . . . Wee Bee, by Bill Chana. P. 14. November.
Piper Pacer Ambulance. Photo. P. 28. December.
Piper Pacer. P. 38. June.
Piper Super Cub. Photo. P. 26. April.
Piper Super Cub. Photo. P. 24. July.
Prest Baby Pursuit. Photo. P. 38. July.
Ryan Navion. P. 39. January.
Ryan Navion. Cover. July.
Stits Junior. Photo. P. 52. April.
The Thing. Photo. P. 52. April.
Wittman Buttercup. Photo. P. 46. September.

PHOTOGRAPHY
Air Photos Pay Off, by H. J. Burrows. P. 30. May.
News Photo Below, by Dee Allen. P. 18. December.

PILOT REPORTS
Beech Bonanza, by Don Downie. P. 18. May.
Bellanca Cruisemaster, by L. M. Horton. P. 16. March.
Cessna 195, by Bob Arentz. P. 16. January.
Cosmic Wind, by Fish Salmon. P. 18. April.
De Havilland Beaver, by Don Downie. P. 21. June.
Ercoupe, by A. H. Hasbrook. P. 14. September.
Fulton Airphibian, by L. M. Horton. P. 14. August.
Hillercopter, by Don Downie. P. 22. February.
Navion 260, by Don Downie. P. 14. July.
Piper Pacer, by Gloria Heath. P. 16. February.
Piper Super Cub, by H. L. May. P. 14. October.
Sailplane plus Power, by L. M. Horton. P. 28. January.
Trojan, by Mardo Crane. P. 20. January.
USAF T-28, by Don Downie. P. 14. December
Wee Bee, by Bill Chana. P. 14. November.

PILOT TRAINING
Air Cadet. P. 24. October.
Hell in the Cockpit, by Lt. H. Searls. P. 24. March.
No Brakes On My Side, by V. A. Prevette. P. 30. December.
Stratocruiser. Photo. P. 30. November.
Test Pilot Training, by Lt. H. Searls. P. 32. April.

PROPELLERS
Octoprop. Photo. P. 48. November.
Prop Spin Pit. Photo. P. 8. December.
Prop with an "Extra". P. 44. January.
Variable-Pitch Prop. P. 36. January.

PROP WASH
Prop Wash. P. 12. January, February, March, April, May; P. 13. June.

QUIZ
Airmen's Quiz. P. 56. August, October, November.
Seth's Safety Quiz. P. 37. April; P. 36. May; P. 37. June; P. 26. July; P. 50. August; P. 56. September; P. 46. November.

RACING AIRPLANES
Pilot's Report: Cosmic Wind, by Fish Salmon. P. 18. April.

RADAR
Airborne Radar. P. 64. October.
Airport Radar by CAA. P. 62. December.
Radar Aids In. P. 62. July.
Radar Progress in G. B. P. 64. December.
Radome—Douglas AD-3W. Photo. P. 8. January.
VOR-DME vs. Airborne Radar, by Col. N. F. Silsbee. P. 62. August.

RADIO
Flying Omnirange. P. 13. December.
Lightplane Radio—High, Low, by Ben Robin. P. 62. October.
Pilot Answers Omni Questions, by Col. S. A. Mundell. P. 61. August.
Pilot Reports Use of VHF Radio, by W. Webb. P. 60. September.
Private, Exec. Pilots Use Omni. P. 63. July.

Procedure for Plane Radio Failure. P. 60. December.
Radio Aids for Business Flying, by Arthur Godfrey. P. 59. August.
Radio Service Director. P. 62. November.
Radio Trainer Unit Developed. P. 58. December.
RTCA in Washington, by Col. N. F. Silsbee. P. 59. July.
Static Chaser, by Jerry Leichter. P. 26. February.
Tailored Radio for Lodestar. P. 60. November.
VOR-DME vs. Airborne Radio, by Col. N. F. Silsbee. P. 62. August.

RESEARCH
Combat—8 Miles Up, by Col. N. F. Silsbee. P. 14. February.
Test-Flight Tom Thumbs, by Terry Kay. P. 22. July.
500 Miles Up, by H. E. Roberts. P. 32. March.

RESCUE
Hell-Bent for Rescue, by Terry Kay. P. 20. April.

ROADABLE AIRPLANES
Aerocar. P. 23. June.
Italian Alaparma 65. P. 23. June.

ROYAL CANADIAN AIR FORCE
RCAF. Photo. P. 52. February.

RUSSIAN AIRPLANES
New Soviet Jet Fighter, by Wm. Green. P. 21. May.

SAILPLANES
Sailplane Plus Power, by L. M. Horton. P. 28. January.
Schweizer 1-23. Photo. P. 8. August.

SEAPLANE
Pilot's Report: Cessna 195, by Bob Arentz. P. 16. January.

SKI-PLANE
North Country Neptune. Photo. P. 46. January.

TAKE-OFF
GA-2. Photo. P. 8. August.
JATO C-125. Photo. P. 8. October.
JATO Navion. P. 39. January.

TRAINING
Aerial Triple-Threaters, by Joseph Stocker. P. 24. December.
Air Cadet. P. 24. October.
Hell in the Cockpit, by Lt. H. Searls. P. 24. March.
Test Pilot Training, by Lt. H. Searls. P. 32. April.

TURBO-PROP
Armstrong Whitworth Apollo. Photo. P. 47. February.
Blackburn Y.A. 5. Photo. P. 63. May.
Blackburn YB-1. Photo. P. 31. November.
Convair Turbo-Liner. Photo. P. 24. June.
Convair XP5Y-1. Photo. P. 25. June.
Convair XP5Y-1. Photo. P. 8. November.
Pratt & Whitney T-34. Photo. P. 8. December.
Turbo-Prop DC-3, by Wm. Green. P. 18. August.
Westland Wyvern. Photo. P. 50. November.

USED AIRPLANES
What's in a Trade, by Ed Hoadley. P. 24. May.

WEATHER
Safe to Fly the Soup, by Col. N. F. Silsbee. P. 14. January.

WIND
Who Has Seen the Wind? P. 53. September.

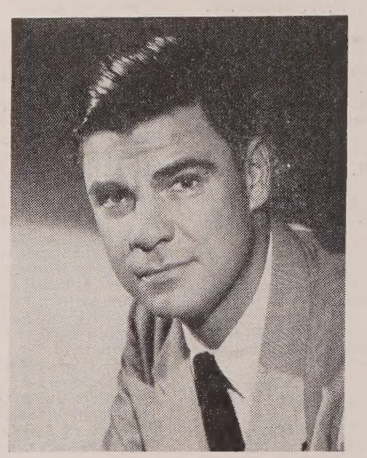
WINTER FLYING
℞ for Winter Flying, by Tex Sallee. P. 30. January.
Watch Out for Ice, by W. A. Dixon. P. 26. December.

SKYWAYS Subscribers

IF YOU MOVE . . .

Send change of address to J. Fred Henry Publications, Inc., 444 Madison Avenue, New York 22, N. Y., at least six weeks before the date of the issue with which it is to take effect. Send old address with the new, and if possible send your address label. Copies will not be forwarded by the postal service unless you supply extra postage.

Airmen's Quiz



Here's that man Bert Parks again! This time the well-known m.c. of NBC's Wednesday evening "Break the Bank" radio and TV show tosses a few questions taken from CAR examinations. Give them a try and see how you'd rate if you were asked to take the official exam over again. Give yourself 10 points for each correct answer. If you miss any, watch out for any CAA officials who might be around when you make a flying CAR *faux pas*. Watch out, too, for your own safety. Better score 100.

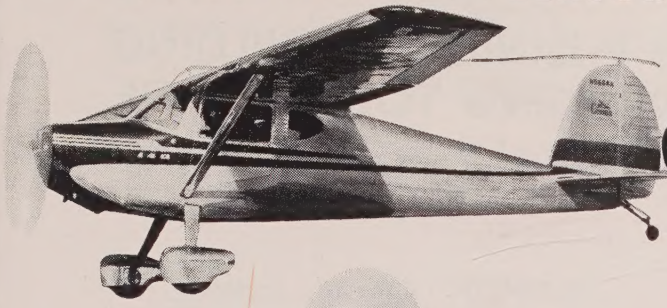
1. Do aircraft while landing or maneuvering for a landing have the right-of-way over aircraft in flight?
   ☐ Yes ☐ No
2. Must a pilot get authorization from the CAA before towing signs, gliders, etc.?
   ☐ Yes ☐ No
3. Does the overtaken plane have the right-of-way over the overtaking one?
   ☐ Yes ☐ No
4. May a private pilot fly an airplane for hire?
   ☐ Yes ☐ No
5. What is the minimum pilot rating required of a pilot flight testing an airplane?
   ☐ Private ☐ Commercial
6. Do private pilot certificates expire 24 calendar months after month of issuance?
   ☐ Yes ☐ No
7. When two planes are on converging flight courses at about the same altitude, one with the plane on its right shall give way.
   ☐ Right ☐ Wrong
8. A student pilot may pilot a plane outside local flying area designated by instructor if he has had 8 hours solo flight time.
   ☐ Right ☐ Wrong
9. A flight instructor must not give more than 8 hours of dual flight instruction in any one day.
   ☐ Right ☐ Wrong
10. When at an altitude of more than 700 feet above ground, a plane must not be flown less than 500 feet vertically and 2,000 feet horizontally from any cloud formation.
    ☐ Right ☐ Wrong

ANSWERS

1. Yes.
2. Yes.
3. Yes.
4. No.
5. Private.
6. No, only student pilot certificates expire in 24 calendar months.
7. Right.
8. No. Student pilot must have had 10 hours solo flight time.
9. Right . . . and no more than 36 hours of dual flight instruction in any 7-day period.
10. Right.

PRINTED IN THE U. S. A. BY THE CUNEO PRESS, INC.

☆ FOR PROFIT — FOR PLEASURE — PICK YOUR PLANE HERE! ☆



CESSNA-140—CROSS-COUNTRY COMFORT FOR TWO . . . with plenty of room for luggage . . . is yours in the all-metal Cessna 140. Quiet, fast, economical. Easy to fly. You can go *where* you want *when* you want...quickly, economically!

CESSNA-170—LUXURY FOR FOUR is what you buy in Cessna's famous "Family Car of the Air" . . . the 170! It's the lowest-priced, 4-place all-metal plane on the market . . . BY SEVERAL THOUSAND DOLLARS. A sensational value!

CESSNA 190 Series—EVERYTHING FOR FIVE! Airline-type engines, airline comfort, shorter take-off, more range, more load, more speed . . . all this plus economical operation is yours in the all-metal CESSNA 190!

COULD YOU USE 400 EXTRA EXECUTIVE MAN-HOURS—without adding to your staff?

Yes, we're offering you 10 extra 40-hour weeks of executive time—during the next twelve months. For that's the amount of travel time even the 2-place Cessna 140 saves on 50,000 air-route miles (57,250 highway miles) of company travel! And a Cessna 170 or 190 will save even more! See your Cessna dealer today and arrange for a practical test of what these planes will do for *you* in *your* business . . . over the routes you and your men travel. You'll be amazed at how little it costs to own and operate an all-metal Cessna—how much speed, comfort and safety they offer. Only Cessna builds a complete line of all-metal personal planes. There's one which fits your business . . . will save time and money for you.

USE THIS COUPON
or See Your Nearest Cessna Dealer

Cessna Aircraft Co.,
Dept. S-6, Wichita, Kansas

Please send free literature giving complete description of the Cessna 140 ( ); Cessna 170 ( ); Cessna 190 series ( ); Literature for model builders ( ).

Name.....

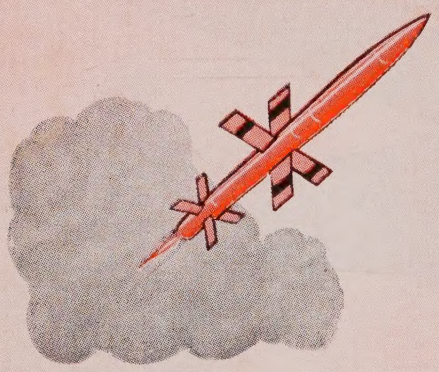
Street.....

City.....County.....

State.....Phone No.....

There's More TO THIS BUSINESS OF BUILDING AIRPOWER THAN THE BRINGING TOGETHER OF MEN, MACHINES AND MATERIALS.

For Example:



ENGINEERS · Convair's engineers are unsurpassed in translating ideas into realities . . . creating unbeatable airpower for America.

FACILITIES · Convair's plants, tools and other equipment are standards of the industry . . . custom-geared for production.

TEAMWORK · Convair's team of more than 25,000 men and women work together with care and conscience . . . a hallmark of integrity ingrained in the organization.

QUALITY · Each Convaircraft is the end product of hundreds of skills. Nothing that flies is better built.

EFFICIENCY · Thoughtful planning saves more than dollars in aircraft production. Convair also is expert in conserving time.

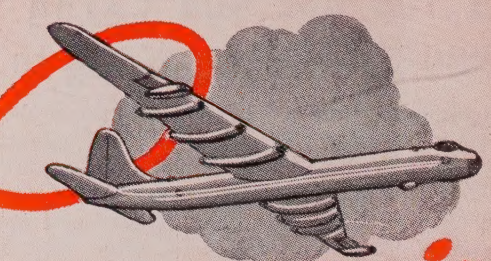
EXPERIENCE · The building of superior airpower, land and water based, has been Convair's business for more than a quarter-century.

PRODUCTION · Convair sets the pace for airframe production, in peace or war . . . for super bombers or luxury transports, flying boats or fighter planes.

– COMPELLING REASONS WHY THE CONVAIR PRODUCTION LINES PAY OFF IN WHAT AMERICA NEEDS MOST.

Security Has Wings!

IN THE AIR -- IT'S



Convair®

CONSOLIDATED VULTEE AIRCRAFT CORPORATION

SAN DIEGO, CALIFORNIA FORT WORTH, TEXAS